TEACHER-CHILD INTERACTION STYLES IN PRE-KINDERGARTEN CLASSROOMS: IDENTIFICATION AND RELATION TO TEACHING PRACTICES AND EARLY LEARNING

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Abstract: This study identified teacher-child interaction styles in pre-kindergarten classrooms and explored the relation between styles and learning outcomes. In Study 1, five dimensions of the Classroom Assessment Scoring (CLASS) that align with conceptualizations of responsiveness (i.e., positive climate and sensitivity) and demandingness (i.e., behavior management, overcontrol, and negative climate) were used to classify teacher-child interaction styles in 694 classrooms from the NCEDL Multi-State Study of Pre-Kindergarten and Study of State –Wide Early Education Programs. Latent Profile Analyses revealed four profiles. Authoritative (n = 156) was highest on responsiveness and behavior management and lowest on overcontrol and negative climate; good enough (n = 364) had average responsiveness and behavior management with low overcontrol and negative climate; authoritarian (n = 33) was lowest on positive climate, sensitivity, and behavior management but highest on overcontrol and negative climate; uninvolved (n = 141) was moderately low on positive climate, teacher sensitivity, and behavior management and above average on overcontrol and negative climate. Initial validation reveals that teachers' observed scaffolding predicts greatest odds of authoritative style, followed by good enough, then authoritarian and uninvolved. Teachers' self-report of traditional child-rearing views predicts greatest odds of authoritarian and uninvolved teacher-child interaction styles followed by authoritative and good enough styles. Study 2 explored the effect of teacher-child interaction style on learning outcomes and whether teacher-child interaction style influences the effectiveness of teaching practices using data from children (N = 2919) in classrooms in Study 1. Multilevel mixture regression models predicting children's math and expressive language learning across the pre-kindergarten year reveal that authoritative and good enough classrooms had students with higher math scores. Authoritative teachers had significantly greater math instructional frequency and better instructional climate, and frequency of math activities significantly predicted gains in math learning only within authoritative classrooms. Students in authoritative classrooms were also engaged in significantly more literacy activities, but this was not associated with better expressive language outcomes. Findings support the use of the CLASS for classifying teacher-child interaction style groups. Future research is needed to examine whether processes differing between styles are related to other behavioral (e.g., motivation, engagement, self-regulation) and academic outcomes.

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CHAPTER I

INTRODUCTION

Relationships between children and teachers are widely understood to form the basis for development and learning in early childhood (Hamre, Pianta, Downer, DeCoster, & Mashburn, 2013; Sabol & Pianta, 2012). However, these relationships are complex, and the way relationships influence learning has been conceptualized in many ways. As others have suggested (e.g., Walker, 2009; Wentzel, 2002), the application of Baumrind's parenting styles framework (Baumrind, 1966; Darling & Steinberg, 1993; Maccoby & Martin, 1983) to classrooms can help organize patterns of teacher-child interactions and provide a basis for understanding the complex interplay among overall classroom climate and specific teaching practices. Although several researchers have outlined the utility of applying this framework and called for new research exploring predictors and outcomes related to style, the empirical evidence is disjointed and sparse, particularly in early childhood. There appear to be several reasons for this. First, most of the previous work focuses on the effect of single dimensions of style (i.e., teacher sensitivity *or* control strategies), yet the unique contribution of Baumrind's framework is that both responsiveness and demandingness are essential contributors to the overall style. Second, many of the studies explicitly applying the parenting styles framework (e.g., Bassett, Snyder, Rogers, & Collins, 2013; Dever & Karabenick, 2011; Lee, 2012; Pellerin, 2005; Wentzel, 2002) have done so in samples of older students. As such, many measures in the literature are not appropriate for

younger samples. The current project aims to address these issues by utilizing a widely used measure to classify teacher-child interaction styles in pre-kindergarten classrooms, identifying predictors of these styles, and finally exploring how styles relate to early learning.

Review of Literature

Baumrind's Parenting Styles

Studies of parenting styles have demonstrated a link between optimal socialization contexts and positive developmental outcomes (Baumrind, 1991; Baumrind, Larzelere, & Owens, 2010), including academic outcomes (Pinquart, 2016). Parenting style is conceptualized as the constellation of parenting qualities that characterize parent socialization of children (Baumrind, 2013). This socialization is grounded in parent belief systems and is a dynamic process of teaching and maintaining standards for behavior and achievement (Baumrind, 2013; Darling & Steinberg, 1993). The parenting styles framework uses the dimensions of parental responsiveness and demandingness to classify types of parents. *Responsiveness* is comprised of parental emotional warmth, commitment, and support for children's independence (Baumrind, 2013; Maccoby & Martin, 1983). *Demandingness* refers to parents expectations and standards for behavior and their willingness to assert control in socialization efforts (Baumrind, 2013; Darling & Steinberg, 1993). Within this framework, control refers to parental regulation of the child or their behavior which can be accomplished in several ways (Barber & Xia, 2013). Baumrind (1973) argues that adults' use of control should respect children's independence and support their gradually increasing ability to self-regulate. Importantly, the parenting styles framework differentiates two types of control: behavioral and psychological. Behavioral control is confrontive regulation of the child's behavior through monitoring, rule and limit setting, and developmentally appropriate reasoning (Barber & Xia, 2013; Baumrind, 2013). The use of confrontive behavioral control allows parents to maintain authority and accomplish socialization goals without squelching children's independence. Conversely,

psychological control is punitive, coercive, and manipulative, which threatens children's self-determination (Barber & Xia, 2013; Baumrind, 2013).

Parenting style is conceptualized typologically, as the effect of one dimension is influenced by high or low levels of the other. Initially, Baumrind described three parenting prototypes. Authoritative parents are high on both responsiveness and demandingness. They are warm and accepting, and they support children's autonomy while appropriately monitoring children's behavior and setting appropriate limits (Baumrind, 2013). Authoritarian parents are highly demanding, using psychological control and punitive methods to establish control while demonstrating low responsiveness and warmth (Baumrind, 2013). In contrast, permissive parents are high on responsiveness but exert low levels of demandingness. Permissive parents are accepting and grant children autonomy, but they do not set expectations for behavior or demonstrate willingness to use confrontive control (Baumrind, 2013). A fourth parenting style, disengaged or uninvolved parenting style was described by Maccoby and Martin (1983). These parents are low on both responsiveness and demandingness, in way that is characterized as rejecting and hostile while also demonstrating lax behavioral control (Baumrind, 2013).

Three other types of parents have also been identified and classified along these dimensions of responsiveness and demandingness. Democratic parents are moderately demanding, and highly responsive (Baumrind, 1991; Baumrind, 2013). Directive parents are highly demanding and moderately responsive (Baumrind, 1991; Baumrind, 2013). They are more autonomy supportive than permissive parents (Baumrind et al., 2010). Good enough parents are moderately responsive, demanding, and autonomy supportive (Baumrind, 1991). Baumrind et al. (2010) classified authoritative, democratic, and directive parenting styles as balanced-committed. Compared with authoritarian, permissive, and uninvolved parenting styles, children from these groups had better outcomes in adolescence (Baumrind, 1991; Baumrind et al., 2010). Children of good enough parents also had more positive adolescent outcomes than children of parents classified as authoritarian, permissive, and uninvolved (Baumrind et al., 2010).

Baumrind's Styles Applied to Classroom Context

The application of the parenting styles framework to teaching can lead to deeper understanding of how teacher-child interactions in the classroom that vary in responsiveness and demandingness relate to children's development. Consistent with the conceptualization of responsiveness in parenting styles, responsive teachers are those who maintain warm relationships with students, are committed to children in their classrooms, and support children's autonomy and independence. Warmth and commitment in the teacher-child relationship are demonstrated through meaningful, engaged interactions, including teachers building a connection with students based on their individual needs and interests (Baumrind, 1973; Pianta, LaParo, & Hamre, 2008). Responsive teachers also demonstrate appropriate nurturance and genuine affection for students (Bondy & Ross, 2008). Responsive teachers act sensitively by providing individualized attention and knowledge of each student's needs, while supporting and assisting the child as needed. This also includes practices such as encouraging children's contribution and supporting children's ideas (La Paro et al., 2009). Some other terms for this construct in the classroom literature include the following: supportive teacher-student relationships (Lee, 2012); teacher care (Dever & Karabenic, 2011; Sandilos, Rimm-Kaufman, & Cohen, 2017; and affection (Kiuru et al., 2012).

In parenting styles research, demandingness refers to parental expectations for children, willingness to exert control to enforce these expectations, and the type of control that parents use (Baumrind, 2013). Likewise, teacher demandingness has been identified as teachers' expectations for children and their use of control to enforce standards (Walker, 2008). As with parenting styles, the difference between demandingness that entails behavioral control versus psychological control is an important distinction. Behavioral control by teachers includes the use of limit setting, establishing consistent routines and procedures, and use of reasoning (Walker, 2008). Psychological control by teachers is characterized by emphasis on obedience and suppression of children's autonomy (Soenens, Sierens, Vansteenkiste, Dochy, & Goossens, 2012). Psychologically controlling teachers exercise control through guilt induction, shaming, threats, and punishment (Kuntsche, Gmel, &

Rehm, 2006; Soenens et al., 2012). In the classroom context, it is important to conceptualize demandingness not only as teachers' classroom management and control, but also as expectations for learning and academic engagement. Teacher demandingness has also been conceptualized as "academic press", or high expectations for academic performance (Dever & Karabenick, 2011; Lee, 2012).

While the dimensions of responsiveness and demandingness may be related to classroom variables, the purpose for using a parenting styles framework is to guide investigation of both dimensions as contributors to the overall classroom socialization climate. Theory suggests that as responsiveness and demandingness increase or decrease, the overall style is very different (Baumrind, 2013; Walker, 2009). Several styles based on high or low responsiveness and high or low demandingness have been described in the parenting styles (Baumrind, 2013) and teaching styles (Ertesvåg, 2011; Walker, 2009) literatures: a*uthoritative* style has high responsiveness and demandingness; *authoritarian* style has high demandingness, but low responsiveness; *permissive* has high responsiveness, but low demandingness; and *uninvolved* is low on both dimensions.

Walker (2008) sought to explore the proof of concept in a sample of middle school math classrooms in a mixed methods study. First, students reported on teachers' responsiveness and demandingness using questionnaires, then principals were interviewed to determine whether their appraisals were consistent with data from students. Through this work, one authoritative, one authoritarian, and one permissive teacher were identified. Then, classroom observations and teacher interviews revealed that differences in the *balance* of responsiveness and demandingness across the three teachers explained differences in students' beliefs about learning, engagement in the classroom, and learning outcomes (Walker, 2008). Expanding on this, researchers have used constructs similar to responsiveness and demandingness to classify other teacher-child interaction styles such as authoritative and authoritarian-inconsistent (Uibu & Kikas, 2012).

Other theoretical perspectives in the literature on teacher-child interactions provide some overlap with the conceptual framework in this study. Literature on warm demanders defines these

teachers as those who establish warm, caring relationships with students, yet also demand respect and maintain high expectations for students' academic engagement (Bondy & Ross, 2008). These teachers believe in every student's ability to succeed and use everyday interactions to build relationships and communicate expectations. Consistent with Baumrind's conceptualizations of style, Bondy and Ross (2008) suggest that warm demanders do this by providing support for learning (i.e., scaffolding), supporting positive behavior, and using clear and consistent expectations. They emphasize that warm demanders are sensitive to student needs but also firmly enforce rules and expectations as needed—without being harsh or coercive (Bondy & Ross, 2008). However, the warm demander literature also emphasizes the importance of cultural responsiveness as an important piece of building warm relationships with students (Ross, Bondy, & Hambacher, 2008; Hambacher, Acosta, Bondy, & Ross, 2016). This literature argues that high expectations and teacher authority are situated in cultural values and must be communicated in culturally relevant ways (Ford & Sassi, 2014).

The concepts of care and control outlined in self-determination theory are also similar to the current conceptualization of responsiveness and demandingness. In a chapter on teacher-child relationships and classroom management, Wubbels, Brekelmans, Mainhard, deb Brok, and Tartwijk (2016) explain that by building relationships characterized by high levels of agency and communion, students become more motivated and engaged and have better academic outcomes. In an empirical study, Nie and Lau (2009) tested the influence of care and behavioral control on classroom climate in a sample of ninth grade students in Singapore. They found that behavioral control negatively predicted misbehavior, care predicted student satisfaction with school, and both were significantly related to classroom engagement.

Measuring Teaching Styles

Previous studies have measured teacher-child interaction styles in several ways. As outlined in the previous sections, several studies have used interviews to understand teaching style (e.g., Ross et al., 2008; Walker, 2008). However, the most common approach appears to be the use of student report of teaching styles using questionnaires (Bassett et al., 2013; Dever & Karabenick, 2011;

Rogers, Bassett, Collins, & Snyder, 2017; Sandilos et al., 2017; Wentzel, 2002). Basset and colleagues (2013) adapted parenting styles questionnaires with subscales for authoritative, authoritarian, and permissive to measure teaching style in college classrooms. Authors from the same group more recently developed the Teacher Control and Nurturance Scale based on responses from undergraduate students (Rogers et al., 2017). This measure relies on student report of two dimensions: nurturance and control. To operationalize warm demander teachers, Sandilos et al. (2017) used fourth and fifth grade students' reports on the challenge, control, and care subscales of the Tripod 7Cs measure. While student-report measures may be useful in samples of older students, they are not practical for use with samples of young children. There are a few studies utilizing teacher self-report of teaching style (Ertesvåg, 2011; Kiuru et al., 2012; Uibu & Kikas, 2014). In a study of first-grade students in Finland, Vijaranta et al. (2015) had teachers' complete daily diaries rating affection, behavioral control, and psychological control across five consecutive days. Mean scores for each of the three subscales were used to predict math and literacy. Another approach to measuring teacher-child interaction style in early childhood samples may be to use an observational measure. Baumrind's (1966) original studies of parenting style utilized observational assessment, yet there does not currently appear to be an observational measure of teaching styles that is used in early childhood classrooms.

One further limitation of current measures of teacher-child interaction style is that many examine the dimensions independently, so they do not provide an overall picture of how dimensions create and overall style. Dever and Karabenick (2011) address this by creating an interaction between academic press and teacher caring. However, this interaction was not significant in their model, so they did not probe effects of different styles. Another way researchers have attempted to solve this problem is to use a single scale giving an overall authoritative score. Baker, Clark, Crowl, and Carlson (2009) summed fourth- and fifth-grade students' ratings of teacher caring, assistance, control, and expectations to create an authoritative score. This method examines warmth and control simultaneously, but it does not allow for identification of any other styles. A few studies have utilized

person-centered methods such as cluster analysis (e.g., Kuntsche et al., 2006) and latent profile analysis (e.g., Kiuru et al., 2012) to identify groups of teacher-child interaction styles.

In order to address the issues outline above, an observational tool that allows for the classification of teacher-child interaction styles in early childhood is needed. The CLASS may be a tool that can be used to operationalize teacher-child interaction styles by measuring responsiveness and demandingness. Further, person-centered methods will allow for identification of subgroups of teacher-child interaction styles.

The CLASS

The CLASS is an observational measure that is widely used in current research and practice. The CLASS has been adopted by least 22 states as part of the statewide Quality Rating and Improvement Systems (QRIS) that are used for licensure and evaluation of child-care centers. It is also required for evaluation of all center-based Head Start grantees by the Office of Head Start (OHS, 2019). It has been used in numerous large-scale evaluation studies. Initially developed as part of the National Center for Early Development and Learning (NCEDL) Multi-State Study of Pre-Kindergarten (Early et al., 2005), it was later revised and used in the MyTeachingParter Study (Pianta et al., 2007) and the NICHD Study of Early Child Care and Youth Development (NICHD ECCRN, 2005) to name a few. The current study utilizes the older version of the measure, but the underlying theory is consistent across both versions.

The theoretical framework underpinning the CLASS is the Teaching through Interactions framework (Hamre et al., 2013). Based in attachment and ecological systems theories, this framework posits that interactions among teachers and students can be organized into three broad domains—emotional support, classroom organization, and instructional support—all of which are promotive of children's developmental outcomes and skills (Pianta et al., 2008; Hamre et al., 2013). Each of these domains is comprised of dimensions that are scored and used as indicators of the overall latent domain (Hamre et al., 2013). The original indicators for emotional support were positive climate, negative climate, teacher sensitivity, and overcontrol, but newer versions revised overcontrol to

measure regard for student perspectives. Indicators for classroom organization are behavior management, productivity, and instructional learning formats and are consistent across old and new versions of the CLASS. Finally, the initial indicators for instructional support were concept development and quality of feedback, with language modeling added in the newer version of the measure.

While the three domain structure of the CLASS has been empirically validated (e.g., Hamre et al., 2013; Li et al., 2019), other factor structures have been explored (for a review see Sandilos, Shervey, DiPerna, Lei, & Cheng, 2016). The current study argues that five dimensions can be used to operationalize responsiveness and demandingness. Teacher responsiveness can be measured with the CLASS using ratings of classroom positive climate and teacher sensitivity. Two types of demandingness can be measured using the CLASS: behavioral control with the behavior management dimension and psychological control with the overcontrol and negative climate dimensions. Figure 1 provides an overview of examples of how measurement of these dimensions map onto teacher-child interaction styles. The examples are taken directly from the descriptions of the CLASS measure (La Paro et al., 2009; Pianta et al., 2008).

This proposed method adapts the published structure by combining the four emotional support dimensions with behavior management (from classroom organization). Other researchers have provided some support for examining these five dimensions. First, an exploratory factor analysis of the early version of the CLASS resulted in only two factors: emotional support (positive climate, negative climate, teacher sensitivity, overcontrol, and behavior management) and instructional support (productivity, concept development, instructional learning format, and quality of feedback; La Paro, Pianta, & Stuhlman, 2004). In a second study, confirmatory factor analysis on the K-3 version of the CLASS compared six different factor structures, revealing that the best fitting model moved behavior management to the emotional climate domain (Sandilos, DiPerna, & The Family Life Project Key Investigators, 2014). While both of these findings demonstrate that the five dimensions

investigated in the current study are interrelated, the current project is the first to examine them as indicators of overall teacher-child interaction style.

Study Objectives

The aim of the current project is to extend empirical work on teaching style to early childhood settings. To accomplish this goal, the proposed dissertation consists of two studies, separated into two manuscripts. In the first Manuscript (Chapter 2), a new approach for measuring teacher-child interaction styles in pre-kindergarten classrooms using an existing measure is presented. As noted above, five dimensions of the Classroom Assessment Scoring System (Pianta et al., 2004) are used to identify latent groups of teacher-child interaction style. Teacher practices and beliefs are used to explore validity of the profiles, and structural quality and demographic characteristics are explored as predictors of style groups. In the second Manuscript (Chapter 3), the same data set is used to extend this work to investigate the relation between teacher-child interaction styles and children's academic skills. Furthermore, teacher-child interaction style as a moderating context for early learning is investigated.

CHAPTER II

MANUSCRIPT 1

Much research has focused on the influence of teacher-child relationships on classroom climate and children's development (for review see Sabol & Pianta, 2012; Gregory & Korth, 2016). Likewise, classroom management and control strategies have been established as important contributors to children's classroom functioning (Wubbels, Brekelmans, Mainhard, den Brok, & van Tartwijk, 2016). However, examining how teacher relationships and control work together, can provide a more complete picture of the classroom context. Some researchers have begun to do this by applying Baumrind's parenting styles theory to socialization by teachers and schools (e.g., Walker, 2009), finding links to academic outcomes (Pellerin, 2005; Walker, 2008).

Although the importance of applying the parenting styles framework to teaching has been demonstrated, empirical work in this area is still limited, particularly in early childhood. Currently, there have been no large scale studies applying Baumrind's framework (1966, 2013) to teachers in early childhood classrooms in the United States. One reason for this may be the lack of an established measure for use in this sample. Thus, the purpose of the current study is to explore the use of a widely used observational assessment, The Classroom Assessment Scoring System (CLASS), to identify teacher-child interaction style categories in pre-kindergarten classrooms using a large multi-state dataset. While many studies have examined classroom quality profiles using the CLASS (e.g., LoCasale-Crouch et al., 2007; Salminen et al., 2012), each

of these conceptualized quality using all measured dimensions of the CLASS. However, multiple other factor structures of the CLASS have been identified and compared (e.g., Li, Liu, & Hunter, 2019; Sandilos, Shervey, DiPerna, Lei, & Cheng, 2016). By narrowing the dimensions to only those consistent with my conceptual framework of teacher-child interaction style, the current study will identify profiles representing conceptually pertinent levels of responsiveness and demandingness. Further, the current study aims to describe differences in teacher-child interaction style profiles to explore construct validity of profiles and describe demographic and structural quality differences among them. Expanding the use of the CLASS to measure teacher-child interaction styles will allow researchers to study this construct in several large extant datasets, as well as pioneer new research using a measurement tool that is widely used and has well-established reliability and validity.

Conceptual Framework

The extension of the parenting styles framework to teaching can provide better understanding of complex teacher-child relationships. Parenting styles theory posits that differing levels of parental responsiveness and demandingness interact to create styles or typologies of parenting that characterize the emotional climate and socialization context in families (Baumrind 1966; Baumrind 2013). Just as parents create the context for socializing family values and goals, teachers can create optimal developmental contexts for student learning and behavior in the classroom (Pellerin, 2005; Wentzel, 2002). Teachers' responsiveness and demandingness act together to create an overall teacher-child interactional style in the classroom. The conceptual framework for the current study is drawn from concepts outlined in literature on parenting styles (e.g., Baumrind 1966; Baumrind, 2013; Maccoby & Martin, 1983), teaching styles (Dever & Karabenic, 2011; Walker, 2008), teacher interactional styles (e.g., Kiuru et al., 2012), and warm demanders (Bondy & Ross, 2008; Ross, Bondy, & Hambacher, 2008).

Research shows that close teacher-child relationships contribute to the classroom climate, influencing academic and psychosocial outcomes (Burchinal, Magnuson, Powell, & Hong, 2015;

Roorda, Koomen, Spilt, & Oort, 2011; Sabol & Pianta, 2012). Teacher *responsiveness* can be defined as warmth, approval, sensitivity to children's' needs, and support for their autonomy (Wentzel, 2002). Teachers create a warm environment by showing interest in students, getting to know them, and by showing care and concern for them (Bondy, Ross, Hambacher, & Acosta, 2012). Responsive teachers are sensitive by encouraging and complimenting students, listening to students' concerns, and providing care and support (Wentzel, 2002). Importantly, responsive teachers demonstrate care and warmth even when students misbehave or struggle in the classroom (Bondy & Ross, 2008; Wentzel, 2002).

Teacher demandingness can be defined as the expectations that teachers have for students and the behavior management and control strategies they use to maintain these expectations (Walker, 2008). Demandingness is important because it establishes standards for classroom behavior and promotes engagement and achievement (Ross et al., 2008). Two types of control described in the parenting styles literature (Barber & Xia, 2013) and in some literature on classroom management (e.g., Wubbels et al., 2014) can be used to distinguish different types of demandingness in classrooms. *Behavioral control* is regulation with the purpose of socializing appropriate behavior according to rules and expectations (Barber & Xia, 2013; Nie & Lau, 2009). Discipline is firm, but respectful of children's abilities and shares responsibility with the child (Baumrind, 1973). Teaching practices that demonstrate this are provision of structure and consistent rules in the classroom (Wentzel, 2002), in addition to communicating clear expectations while maintaining mutual respect (Wubbels et al., 2014). Teachers using appropriate behavioral control anticipate and prevent problems, monitor behavior, and redirect students as needed (Bondy & Ross, 2008). Alternatively, *psychological control* is regulation that restricts autonomy and coerces conformity (Barber & Xia, 2013; Soenens, Sierens, Vansteenkiste, Dochy, & Goossens, 2012). Teachers who are psychologically controlling impose teacher-centered strict rules and rigid structure, and they do not allow student agency or autonomous decision making within the classroom (Wubbels et al., 2014). Further, teachers who exhibit psychologically

controlling demandingness use punitive and harsh strategies (e.g., guilt induction, punishment, yelling) to make children obey their rules without negotiation or reasoning (Kuntsche, Gmel, & Rehm, 2006; Soenens et al., 2012).

While the examination of warm teacher-child relationships and behavior management strategies in early childhood is not new, the unique contribution of applying the parenting styles framework is the emphasis on examining both dimensions simultaneously, as they are both indicators of a larger constellation that makes up the overall style (Dever & Karabenic, 2011; Walker, 2009). By combining high levels of responsiveness and demandingness, *authoritative* teachers maintain high expectations for students' behavior and classroom performance while supporting students' autonomy and providing warm, individualized interaction (Uibu & Kikas, 2014). Authoritative teachers focus on preventing problems in the classroom as much as possible, while appropriately monitoring, responding, and setting limits as needed (Ertesvåg, 2011). As such, an authoritative classroom is characterized by a warm climate with mutual respect and clear rules and routines. When necessary, authoritative teachers gain compliance using reasoning (Walker, 2008) and consequences (Ross et al., 2008). Authoritative teachers are not reactive, harsh, or punitive. By acting responsively, authoritative teachers provide the supports needed for students to meet demands (Walker, 2009).

Authoritarian teachers are also highly demanding, but when this is combined with low levels of responsiveness, it comes across as restrictive and rigid (Baumrind, 1973; Ertesvåg, 2011). Students must follow rules and plans made by the teacher, regardless of individual needs or interests. In order to gain compliance, authoritarian teachers use psychologically controlling tactics; they are punitive, threatening, coercive, and may even use corporal punishment (Uibu & Kikas, 2014). Authoritarian teachers do not engage in negotiation with students or provide individualized support. They emphasize obedience and discipline, using punishment to gain compliance (Bondy & Ross, 2008).

Conversely, *permissive* teachers have high responsiveness and low demandingness. They are warm toward students and grant them autonomy, but do not clearly articulate or enforce expectations or limits (Uibu & Kikas, 2014). In a permissive classroom, students are allowed to freely make their own decisions and choices. However, teachers may allow students to misuse materials, disrupt lessons, or misbehave, either because they view control as harsh or because their attempts to enforce rules are ineffective. Control and management of routines and behavior in the classroom may be low or inconsistent (Walker, 2008).

Uninvolved teachers have low responsiveness and demandingness (Kiuru et al., 2012). Similar to permissive teachers, their expectations, routines and procedures may be unclear or inconsistent. Coupled with low responsiveness, this teacher-child interaction style can be rejecting and dismissive (Ertesvåg, 2011). Thus, uninvolved teachers are not emotionally invested in building relationships with students, nor do they provide emotional support and encouragement. Likewise, uninvolved teachers do not provide individualized supports or help students solve problems in the classroom.

Other combinations of levels of responsiveness and demandingness have been empirically identified in groups of teachers. Using Latent Profile Analysis, Uibu and Kikas (2014) identified an *authoritarian-inconsistent* teacher-child interaction style characterized by high behavioral control, high psychological control, high inconsistency in discipline, and low encouragement/affection. Using cluster analysis, another study identified *ambivalent* teachers as high on control, psychological pressure, and moderate on warmth (Kuntsche et al., 2006). Other combinations of responsiveness and demandingness have also been identified in parents. Baumrind (1991, 2013) described authoritative-like parenting styles: *directive* with moderate responsiveness and high demandingness, *democratic* with high responsiveness and moderate demandingness, and *good enough* with moderate responsiveness and moderate demandingness. However, no studies of teacher-child interaction style have explored or identified these authoritative-like styles.

Measuring Style with the CLASS

The CLASS is a widely used observational measure, developed to assess the quality of interactions between teachers and children in three domains: emotional climate, classroom organization, and instructional climate (Hamre, Pianta, Downer, DeCoster, & Mashburn, 2013). Each of these domains is measured using multiple dimensions as indicators. However, five of the dimensions of the CLASS also tap into teacher responsiveness and demandingness- constructs central to the measurement of teacher-child interaction styles. Consistency between conceptual definitions outlined in the previous section and the operationalization of analogous constructs in the CLASS makes this measure a good option for identification of styles. The CLASS measures teacher responsiveness (i.e., warmth, sensitivity, care) using ratings of classroom positive climate and teacher sensitivity. Positive climate measures warm teacher-student relationships, positive communication, and positive affect, while teacher sensitivity measures responsiveness to academic and emotional needs, individualized help and support, and students' use of the teacher as a secure base (Pianta, La Paro, & Hamre, 2008).

The two types of demandingness can also be measured using the CLASS: behavioral control (central to authoritative style) and psychological control (central to authoritarian style). CLASS behavior management operationalizes positive behavioral control by measuring clear and consistent behavior expectations, monitoring, and appropriate responses to misbehavior (Pianta et al., 2008). Conversely, psychologically controlling aspects of demandingness can be measured using CLASS overcontrol and negative climate ratings. Overcontrol measures aspects of psychological control which diminish students' autonomy such as rigidly structuring the classroom (La Paro et al., 2009). This dimension also includes two dimensions that—after reverse coding—reflect psychological control and threats to children's autonomy: following the child's lead and listening to and taking children's ideas into account (La Paro et al., 2009). Finally, negative climate measures teacher's punitive control, negative affect, and sarcasm (Pianta et al., 2008), which are also consistent with definitions of psychological control (Soenens et al., 2012).

There are several advantages to the use of the CLASS for operationalizing teacher-child interaction style. The first is in its conceptual similarity to the current framework. The CLASS is designed to measure the overall climate or pattern of teacher-child interactions. This is consistent with Baumrind's conceptualization of parenting style (Baumrind, 2013; Darling & Steinberg, 1993) and more recently developed conceptualizations of teacher-child interaction style (Uibu & Kikas, 2014; Walker, 2008) as an overall socialization climate characterized by responsiveness and demandingness. However, because CLASS scores are based on both teacher and student behavior, the term *teacher-child interaction style* is used in this paper, rather than teaching style. A second strength is that this measure was developed to evaluate interactions between students and teachers across age ranges, and versions of the measure have been developed for use from infancy through high school (see descriptions in Pianta et al., 2008). This will allow researchers to examine the influence of teacher-child interaction style longitudinally, as has been done with parenting style (e.g., Baumrind, Larzelere, & Owens, 2010). Furthermore, there are many datasets already using this measure (see Perlman et al., 2016). Secondary analysis of these data will allow researchers to answer new questions about teacher-child interaction style using existing data sets.

Validity

Teacher characteristics can be used to establish validity of teacher-child interaction styles identified based on CLASS ratings. The current study uses ratings of teachers' beliefs and observations of teachers' scaffolding to explore construct validity of teacher-child interaction style. Teacher and classroom characteristics are also included as covariates and are used to describe differences in predictors of each style.

Teachers' beliefs about socialization influence their teacher-child interaction style. According to parenting styles theory (Baumrind, 2013; Darling & Steinberg, 1993), parenting values and beliefs inform parents' socialization goals and practices used to accomplish these goals. Baumrind (1966) describes authoritative parents as valuing children's conformity to behavioral expectations while emphasizing child autonomy and self-will. Authoritarian parents

value conformity and obedience to authority over children's autonomous thinking, which leads to these parents' use of psychologically controlling practices (Baumrind, 1966). Conversely, permissive parents value children's autonomy without having expectations for conformity, so they use few, if any, controlling practices (Baumrind, 1966). By applying this framework to the classroom, researchers can use teachers' attitudes and beliefs about socialization to establish validity of their teacher-child interaction style. One study specifically looked at differences in instructional goals and methods across teacher-child interaction style groups (Uibu & Kikas, 2014). The researchers found that authoritative teachers reported greater emphasis on having goals for promoting students' individuality and allowing students to express their own opinion than authoritarian-inconsistent teachers. Several studies have examined traditional and progressive child-rearing beliefs in teachers (Castle et al., 2016; LaParo et al., 2009). Traditional beliefs emphasize obedience, conformity, and structure, while progressive beliefs demonstrate value for individuality and independent thinking. Traditional child rearing beliefs are consistent with the authoritarian values described by Baumrind (1966), whereas progressive beliefs are consistent with the values of authoritative and permissive styles. Therefore, it is hypothesized that teachers with more traditional beliefs will have teacher-child interaction styles that are more psychologically controlling.

Specific teaching practices can also be used to establish validity of teacher-child interaction styles. Scaffolding is the practice of teaching by providing varying levels of support contingent upon the learner's performance (Mermelshtine, 2017; Ritchie, Kraft-Sayre, Howes, & Weiser, 2001)). A large body of research has demonstrated links between scaffolding and positive developmental outcomes, such as executive function, cognitive ability, and classroom competence (Mermelshtine, 2017). This practice is an important part of teacher-child interaction styles because it requires teachers to demonstrate sensitivity and attunement to children's needs and ability, while responding appropriately to support their autonomous learning. Research on parenting styles provides some empirical evidence of differences in scaffolding among styles.

Authoritative parenting has been associated with greater levels of scaffolding practices (Mermelshtine, 2017). Specifically, Carr and Pike (2012) found that parental report of authoritative parenting (affection and positive discipline) was positively related to contingent scaffolding, while authoritarian parenting (harsh discipline) was negatively related to contingent scaffolding and positively related to non-contingent responses when children needed more support (Carr & Pike, 2012). Given these findings, it is expected that scaffolding will differ among teacher-child interaction style profiles, with teachers who are in profiles characterized by higher responsiveness and sensitivity using greater scaffolding.

The Current Study

The first goal of this study was to identify teacher-child interaction styles in pre-kindergarten classrooms using CLASS observations (positive climate, negative climate, behavior management, teacher sensitivity, and overcontrol). Latent profiles of teachers were identified and described using dimensions of responsiveness (positive climate and sensitivity) and demandingness (behavior management; overcontrol and negative climate). I hypothesized that authoritative, authoritarian, permissive, and uninvolved profiles would be identified. However, I recognized that the profiles that emerged may align with other styles identified in the literature such as democratic, directive, and good enough.

The second research goal was to use teacher beliefs and scaffolding to establish validity for profiles as teacher-child interaction styles, controlling for teacher and classroom demographic and structural characteristics. The first hypothesis is that traditional teacher beliefs will be more characteristic of psychologically controlling profiles than profiles of teachers who have low psychological control. The second hypothesis is that scaffolding will be more characteristic of responsive profiles than profiles with lower responsiveness.

Method

Participants and Procedure

Data for this study were from the public-use version of Pre-Kindergarten in Eleven States: National Center for Early Development and Learning Multi-State Study of Pre-Kindergarten and Study of State-Wide Early Education Programs (Early et al., 2013). For these two studies pre-kindergarten sites were selected using stratified random sampling in eleven participating states. Within each site, one pre-kindergarten teacher and four randomly selected students from each classroom were recruited to participate. For detailed sampling and recruitment procedures see Early et al. (2013).

The current study includes 694 teachers from this dataset. Teachers completed demographic and self-report questionnaires, parents of all children in the classes (not just those selected to participate in the study) reported demographics, and trained researchers conducted observations in each classroom. Reliability data for all observations and questionnaire scales were obtained from the user guide for the public-use data file (Early et al., 2013).

Classrooms were as follows: 61.3% located in a public school, 42.2% full-day programs, and 15.5% Head Start programs. Of the 694 lead classroom teachers, 692 are female. Teacher ethnicity was reported as 67% White; 19% Black, Native American, Asian, or other; and 14% Latin American. Education ranged from HS or less to Doctorate, with 68.8% of teachers having a BA/BS or higher.

Measures

Teacher-child interaction style. Five dimensions of the CLASS (Pianta et al., 2004) were used to classify teacher-child interaction styles. During original data collection, CLASS raters observed the pre-kindergarten classrooms in 30-minute segments and rated each dimension on a scale from one to seven for that period. At least four segments from the observation day were averaged to calculate the final score for each dimension. Ratings of 1 and 2 were considered low, 3 to 5 were considered mid-range, and ratings of 6 or 7 were considered high. Reliability for coding was tested during training before data collection using comparison between raters and a

gold-standard response prepared by the instrument authors (LaParo, Pianta, & Stuhlman, 2004). Mean weighted Kappa for all CLASS dimensions in the total sample is .65.

The five CLASS dimensions used in this study are: positive climate, teacher sensitivity, behavior management, negative climate, and overcontrol. Positive climate includes indicators of teacher and student respect, positive communication and affect, and warm relationships. Teacher sensitivity is rated based on teacher support of and responsiveness to children and awareness of and attention to student needs, concerns, and problems. Behavior management includes clear and consistent expectations, proactive anticipation and monitoring of behavior problems, and effective redirection of misbehavior. Negative climate is rated based on disrespect and negative affect between teachers and students and punitive control (e.g., threats and yelling) by the teacher. Overcontrol includes ratings for rigidity and regimented classroom structure, autonomy support (reverse), and consideration of student ideas (reverse).

Teacher beliefs. Teachers' traditional child rearing beliefs were reported using the Modernity Scale (Schaefer & Edgerton, 1985). This 16-item scale includes items such as, "Children should always obey the teacher" (traditional) and "Children should be allowed to disagree with their parents if they feel their own ideas are better" (progressive). Agreement was rated from one to five. Progressive ratings were reverse scored, and a sum score was calculated for the 16 items. Thus, higher scores represent more traditional or authoritarian child-rearing beliefs. In the total sample, Cronbach's alpha was .79.

Scaffolding. Scaffolding was coded using the Emerging Academics Snapshot (Ritchie et al., 2001). Using this measure, researchers observe 20-second increments and code presence of 27 different behaviors in the following 40 seconds. Classrooms were assessed during the same session(s) as the CLASS observations. The average proportion of occurrences present in a coding period across the observation day was calculated for each child. Subsequently, averages across participant children within the classroom were also calculated. For this study, proportions were converted to percentages for interpretability of odds ratios. Reliability was calculated by

comparing observations of video tapes with a gold-standard data collector. Mean Kappa was .59 for scaffolding in this sample.

Covariates. Teacher and classroom covariates are summarized in Table 1. Teacher characteristics included in analyses were as follows: teacher education, certification, and race/ethnicity. Teacher education was rated from 1 (High School or less) to 7 (Education Specialist, Professional Degree, or Doctoral Degree). Two dichotomous certification variables were computed: State certificate to teach pre-kindergarten (0/1) and has a Child Development Associates credential (0/1). Three categories of teacher race/ethnicity were used: White, Latino, and Black, other, multiple. Classroom characteristics included the following: classroom location, length of day, child-staff ratio, maternal education, family income, gender, and children's race ethnicity. Classroom location was categorized into four dichotomous variables as: public school, Head Start, both, or neither. Classrooms were considered full day when they met for more than 20 hours per week. Maternal education was reported in years and averaged across all children in the classroom to create a single score for each room. Classroom poverty was calculated as the percent of poor families in the classroom. Family income was divided by the federal poverty level for household size. Families were considered poor if they were below 150% of the federal poverty level. Finally, parents reported on students' race/ethnicity and percentages of classroom composition were calculated for each category: White, Black, Native American, Latino, Asian, and other or multiple races.

Analytic Strategy

The first aim of this study was to identify teacher-child interaction styles in pre-kindergarten classrooms using CLASS observations. This was investigated using Latent Profile Analysis (LPA) in M*plus* version 7.3 (Muthén & Muthén, 1998-2014). LPA is a type of mixture modelling that uses observed continuous variables to empirically identify meaningful homogenous latent subgroups of people (Collins & Lanza, 2010). Observed CLASS dimensions

of positive climate, negative climate, overcontrol, behavior management, and teacher sensitivity were used as indicators of teacher-child interaction style profiles.

In order to select the most parsimonious LPA solution, increasingly complex models starting with a 1-class model were estimated and compared. Models were evaluated using criteria recommended by Samuelsen and Raczynski (2013) for assessing model fit, classification quality, and interpretability of the latent profiles. Model fit was evaluated using Akaike's Information Criterion (AIC), Bayesian Information Criterion (BIC), and the adjusted Bayesian Information Criterion (aBIC). For each of these fit statistics, a lower value represents a better fitting model. The Vuong-Lo-Mendell-Rubin (VLMR), adjusted Lo-Mendell-Rubin test (LMR), and bootstrap likelihood ratio test were used to compare models as each additional latent class was added to the model. A significant likelihood ratio test suggests that the model with greater number of profiles is a better fit. Classification quality was evaluated using entropy values, with values closer to one indicating better classification. Finally, interpretability of the latent profiles was examined according to number of teachers assigned to each profile and means of indicators for each group.

The second aim of this study was to establish validity of the teacher-child interaction style categories generated by LPA. To do this, teacher beliefs and scaffolding, controlling for characteristics of the teacher, classroom, and students were examined as predictors of class membership using the 3-step method explained in Asparouhov and Muthén (2014). This approach is preferred because it accounts for error in classification of profiles and because it allows for the estimation of the LPA model independently from the auxiliary predictor variables (Asparouhov & Muthén, 2014). The first step is to estimate the latent class model. Then, a variable is created for the most likely class membership accounting for classification error in the probabilities of class membership. In the third step, the auxiliary variables (i.e., traditional teacher beliefs, scaffolding, teacher demographics, classroom characteristics) were tested as predictors of the latent class variable using multinomial logistic regression. Because only one teacher per school was sampled

and student variables were averaged across the classroom to create a classroom-level score, multi-level analysis was not used.

Missing data were handled in two ways. First, 27 teachers (3.7% of sample) were identified with missing values on the LPA indicators. These teachers did not have valid observations for CLASS data because they did not remain in the same classroom with the same children during the school year, so they were removed from all analyses. This left a final sample of 694 classrooms. For missing data on predictors of profile membership (percentages reported in Table 1), full information maximum likelihood (FIML) estimation in M*plus* was used to estimate the model using all available observations.

Results

Teacher-child interaction style profiles

Choosing model. To answer the first research question, five LPA models were compared to determine the best-fitting model. Indices for model fit and number of participants in each class are reported in Table 2. Significance of the VLMR, LMR, and bootstrap likelihood ratio tests were significant in the two-profile solution and entropy was high. However, AIC, BIC, and aBIC fit statistics continued to decrease with each additional model, suggesting that the model continued to improve with each additional class. Likelihood ratio tests were also significant in the four profile solution, and entropy was still high. In the five-profile model, the smallest class had only seven classrooms—a very small percentage of classrooms (1%). In consequence, the four-profile solution was selected because decreases in fit statistics, significant likelihood ratio tests, adequate entropy, and meaningful profile sizes represented a parsimonious and interpretable solution.

Interpreting classes. Estimated descriptive statistics for each of the five indicators based on most-likely class membership in the four profiles are reported in Table 3. Means for each of the teacher-child interaction dimensions were compared using the model constraint test of parameter estimates and the Delta method for estimating standard errors (Muthén & Muthén,

2012) and used to interpret profiles as styles. Profiles had significantly different means across all dimensions. As shown in Figure 2, the profile with the highest positive climate and sensitivity (responsiveness) was also the highest in behavior management (behavioral control), and the lowest in overcontrol and negative climate (psychological control)—consistent with definitions of *Authoritative* style. The Authoritative style profile contains 22.5% of the sample. The largest profile (52.4%) was close to the mean on all five teacher-child interaction style indicators and was called *Good Enough*. The profile with low positive climate, sensitivity, and behavior management and above average overcontrol and negative climate was called *Uninvolved* (20.3%). Finally, the smallest profile (4.8%) had very low positive climate, sensitivity, and behavior management, and the highest negative climate and over control, so it was called *Authoritarian*.

Predictors of teacher-child interaction styles

The final research goal was to use teacher beliefs and scaffolding to distinguish styles, controlling for teacher and classroom characteristics. Results of the multinomial logistic regressions exploring predictors of each combination of styles are included in Table 4. Scaffolding was a significant predictor of styles hypothesized to have higher responsiveness, supporting Hypothesis 1. More specifically, greater use of scaffolding by teachers predicted lower odds of good enough (OR = .89), authoritarian (OR = .68), and uninvolved (OR = .76) compared with authoritative teacher-child interaction style. Further, greater scaffolding predicted lower odds of uninvolved (OR = .85) or authoritarian (OR = .77) style compared to good enough. Use of scaffolding was not associated with significantly different odds of classification as authoritarian compared to uninvolved style profiles.

The second hypothesis was that teachers' traditional child rearing beliefs would differentiate demandingness among style profiles. As expected, an increase in traditional beliefs predicted increased odds of authoritarian style compared with authoritative (OR = 1.08) and good enough (OR = 1.08) profiles. Similarly, more traditional beliefs predicted greater odds of uninvolved teacher-child interaction style compared with authoritative (OR = 1.08) and good

enough (OR = 1.07). Traditional beliefs did not predict significant difference in odds of good enough compared with authoritative (OR = 1.01) or authoritarian compared with uninvolved (OR = 1.00).

In the multinomial logistic regressions above, teacher and classroom characteristics were included as covariates but can also be used to describe differences among styles (see Table 4). These results suggest that more teacher education predicted significantly greater odds of authoritarian teacher-child interaction style. Controlling for education and all other covariates, having a state certificate to teach pre-k did not predict odds of style, nor did the interaction between education and certification. However, having a CDA was associated with much lower odds of authoritative style, holding all other variables, including state pre-k certification, constant. Classroom location did not predict style, but full day programs were more than twice as likely to be classified as uninvolved compared with authoritative and good enough. Greater child to staff ratio explained some difference in odds of authoritative compared with good enough interaction style. Although effect sizes were very small, some classroom racial and ethnic percentages predicted some differences among profiles. When a greater percentage of the children in the classroom was identified as Black, there were significantly greater odds of authoritarian teacher-child interaction style, compared to all other styles. Greater percentage of Latino students in the classroom predicted lower odds of authoritative than good enough and greater odds of uninvolved compared to good enough. When a greater percentage of students were identified as other or multiple races, there were significantly greater odds of uninvolved compared to good enough teacher-child interaction styles.

Discussion

The goal of this study was to use the CLASS to identify profiles of pre-kindergarten teacher-child interaction styles using a conceptual framework based on teaching styles (Walker, 2008; Wentzel, 2002) derived from Baumrind's (1966; 2013) parenting styles framework. Results of this study suggest that this sample of teachers can be categorized into four empirically

homogenous styles of teacher-child interactions. The identification of these profiles that are consistent with this conceptual framework demonstrate the importance of examining both responsiveness and demandingness as unique contributors to interactions among students and teachers. This provides support for the application of parenting style theory to classrooms, but also has important implications for interpretation of CLASS scores.

The authoritative profile was clearly highest on responsiveness and behavioral control (i.e., behavior management), while very low on psychologically controlling aspects of demandingness. This style is conceptually consistent with the authoritative style profile described in other samples (e.g., Kiuru et al., 2012; Walker, 2008). The good enough profile was a very interesting finding because it is not one of the four prototypical styles. However, these teachers are clearly average on responsiveness and demandingness and contained approximately half of the sample. This is consistent with descriptions by Baumrind (1991) of good enough parents as moderate on both responsiveness and demandingness, with scores ranging from medium-low to medium-high on directive control, assertive control, and supportive control. The authoritarian profile was also conceptually consistent with previous descriptions of authoritarian teaching (Walker, 2008). These teachers demonstrate the greatest amount of psychologically controlling practices, coupled with low levels of developmentally appropriate classroom management, warmth, and sensitivity. Finally, the uninvolved profile was characterized by low responsiveness and behavioral control and greater negativity and intrusiveness than was the case for authoritative and good enough. This is consistent with Maccoby and Martin's (1983) conceptualization of uninvolved parents as low on responsiveness, low on demandingness, and sometimes harsh in interactions with children when effort is required that they are unwilling to exert. Similar profiles have been identified in Swiss (Kuntsche et al., 2006) and Finnish (Kiuru et al., 2012) samples.

Unexpectedly, a *permissive* teacher-child interaction style was not identified in the LPA. One possible reason for this may be that low demandingness in an early childhood classroom may be inherently associated with negative climate. Baumrind (1968) argues that permissive parents

who allow children to misbehave convey a message of approval rather than a neutral tone. In the classroom context, this may result in a chaotic environment with negative interactions among children and with the teacher. For this reason, teachers with permissive ideologies may appear more uninvolved when using CLASS observations.

Predictors of Teacher-child Interaction Styles

Teacher scaffolding explained differences in teacher-child interaction styles as expected. Teachers with greater odds of belonging to style groups conceptualized as having greater responsiveness were observed scaffolding target children in the classroom for a greater percentage of time. Further, teachers' reports of traditional versus progressive child rearing beliefs discriminated between teacher-child interaction styles conceptualized as using appropriate behavioral control and those using harsh and punitive psychological control. Teachers who endorse more traditional authoritarian child-rearing beliefs were more likely to use those practices in the classroom. Together these, findings demonstrate initial concurrent validity of these teacher-child interaction styles. However, validation across other samples is needed.

Teacher and classroom characteristics included as covariates provide some understanding of structural quality differences between teacher-child interaction styles. First, classrooms with authoritative teacher-child interaction style were less likely to have a lead teacher with a CDA than other groups. Moreover, teachers with a CDA were six times more likely to be classified as authoritarian compared to authoritative. This finding is not consistent with previous findings that having a CDA is associated with adoption of more developmentally appropriate practices (e.g., Heisner & Lederberg, 2011). Second, a lower child-staff ratio explained some difference in odds of authoritative compared to good enough style, suggesting that more one-on-one time with students may allow teacher greater opportunity to engage in the highest levels of warm and supportive interactions with students. Gordon, Fujimoto, Kaester, Sorenman, and Abner (2013) found that higher child-staff ratios are associated with poorer quality classrooms, particularly with measures of language and interactions. Additionally, when ratios are smaller teachers can

provide individualized interaction for managing classroom engagement and misbehavior (Blatchford, Bassett, & Brown, 2011). Finally, findings suggest that full-day classrooms are more likely to be uninvolved. This may be caused by increased teacher stress or exhaustion and burnout in programs with a longer day. Mashburn, Hamre, Downer, and Pianta (2006) found that students in full-day programs had more behavior problems and conflict with teachers. Higher levels of conflict over an extended school day may lead to teachers' disengagement from interactions with students.

There were several significant—albeit small—effects suggesting racial makeup of classrooms predicting profile membership. This highlights a need for more nuanced exploration of teacher-child interaction across racial groups. Findings clearly suggest that classrooms with a greater percentage of Black students were significantly more likely to be classified in the authoritarian profile. This finding is not surprising given the literature on bias in discipline and teacher-child relationships for Black students (see Gregory & Korth, 2016). However, another explanation outlined by Bondy and Ross (2008) is that culturally relevant communication with Black students may appear harsh to some observers, even when such communication is interpreted as caring by students.

Strengths and Limitations

This study has several strengths. The sample was large and diverse with respect to location and classroom characteristics. Because of the large sample there was adequate power to conduct LPA analyses and compare characteristics across groups. LPA was advantageous in this study because it allowed for identification of homogenous styles of teacher-child interaction to be identified using person-centered methods. Identification of groups is central the conceptualization of overall styles. Another strength of this study is that it relied on both observational data and teacher-report of beliefs. This allowed for a more complete picture of the socialization context and helped with validation.

While the archival nature of this data was a strength for sample size and high quality data collection, it also presented some limitations. Variable selection was limited to availability in the dataset. Other measures of teacher beliefs and socialization practices might have provided better validation of the profiles. Another particular limitation was that the teachers' race variable collapsed teachers who identified as Black, other, and multiple races into one category. This limited the comparisons among groups. Given the findings that classrooms with more Black students were more likely to be in the Authoritarian profile, further investigation of differences in teacher-child interaction style across different teacher race/ethnic groups is warranted. A final limitation is that the data in this study use an older version of the CLASS that has been revised. The overcontrol dimension was removed and replaced with *regard for student perspectives* because of issues with limited variability and skewness (Hamre et al., 2013; Pianta, 2008). Given the issues with limited variability, findings for this variable should be interpreted with caution. The current study identified a small group of classrooms with high overcontrol ratings, but perhaps the newer, more sensitive measure, can better distinguish psychological control and autonomy among style groups.

Directions for future research

Because this was the first study to identify teacher-child interaction styles using the CLASS, there are many directions for future research. An important first step is to seek to replicate these findings in other samples using the CLASS. Many existing datasets (see Li et al., 2019 for review) are already available, so teacher-child interaction styles for other pre-kindergarten classrooms and samples across elementary, middle, and high school should be explored. Additionally, future work should seek to validate these styles further. Construct validity should be explored through examination of styles related to other teacher-child relationship and classroom management variables.

As discussed in the previous section, the overcontrol dimension has been heavily revised in newer CLASS versions. Future work should explore whether similar profiles emerge using the

newer regard for student perspectives dimension. In the current study, overcontrol was used as an indicator of psychologically controlling teaching because it measured rigid classroom structure that was not adaptable to children's individual needs and interests. The newer dimension, regard for student perspectives, still measures teachers' regimented control, but ratings are also highly influenced by more positive aspects of autonomy support. As such, a psychologically controlling classroom would have *low* ratings for regard for student perspectives coupled with high negative climate ratings.

Finally, another important next step is to see how teacher-child interaction styles relate to child behavior and learning. Previous work has demonstrated that styles using similar frameworks are related to students' academic motivation (e.g., Walker, 2008) and learning outcomes (e.g., Kiuru et al., 2012). Thus, an examination of the impact of the styles identified in the current study on children's learning is warranted. Although authoritative style is considered the optimal style, almost half of the teachers in this study comprised a single good enough profile. Future work should explore whether student outcomes suggest that these teachers are actually *good enough* in promoting students' positive development.

Implications for practice

The current paper highlights the importance of examining both responsiveness and demandingness in conceptualizations of teacher-child interactions. Many aspects of teacher evaluation and training have focused on improving teacher-child relationships. However, findings in this study suggest that teacher expectations and control are also an important piece of the socialization context. As such, the two dimensions should be considered together when evaluating classroom quality. The wide use of the CLASS in state Quality Rating Improvement Systems (QRIS) provides unique opportunities for measuring and targeting teacher-child interaction styles. At least half of states use the CLASS as part of QRIS for either quality ratings or quality improvement. Considering combinations of levels of responsiveness and demandingness when interpreting scores can provide more nuanced guidance for evaluation and improvement in these

programs. These findings also emphasize the importance of CLASS dimension scores rather three domain scores, or a single overall score, which is often used for quality ratings. Finally, predictors of teacher-child interaction styles can guide improvement for authoritarian and uninvolved teachers by supporting certain teachers (e.g., those in full-day programs) and by influencing policies for minimum standards (e.g., minimum certification, class sizes, and ratios).

Conclusion

The current study examined teacher-child interaction styles by adapting the parenting styles framework and using five dimensions of the CLASS. Findings provide support for the use of the CLASS in this way and highlight the need for examining responsiveness and demandingness together using person-centered methods. Although most teachers were classified as authoritative and good enough, a significant portion of the classrooms sampled had uninvolved and authoritarian teacher-child interactions styles. These classrooms are characterized by low responsiveness and negativity, which may have an important impact on children's classroom engagement and learning.

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CHAPTER III

MANUSCRIPT 2

Currently, much work focuses on how teacher-child interactions relate to behavioral and learning outcomes for children (Hamre, Pianta, Downer, DeCoster, & Mashburn, 2013). Identification of teacher-child interaction styles based on Baumrind's (1966; 2013) parenting styles framework is one line of research that has led to insights about teaching methods and instructional goals (Uibu & Kikas, 2014), student motivation and interest (Dever & Karabenick, 2011), and student behavior problems (Chen, Cheng, Liang, & Sato, 2012). Some studies have demonstrated links between teacher-child interaction style and academic achievement in elementary school (Baker, Clark, Crowl, & Carlson, 2009; Kiuru et al., 2012), middle school (Aldhafri & Alrajhi, 2014; Walker, 2008), high school (Dever & Karabenick, 2011), and college (Bassett et al., 2013). However, very little research has examined whether this construct is associated with academic growth prior to first grade. The purpose of the current study is to examine the relation between teacher-child interaction styles and early learning gains in pre-kindergarten. Further, the current study aims to determine whether teaching practices are more effective in some teacher-child interaction style contexts than others, predicting greater growth in early learning across the pre-kindergarten year. Such differences would imply that teacher-child interaction styles moderate the link between teaching practices and children's learning.

Background on Teacher-Child Interaction Style

Teacher-child interaction styles are the overall constellation of socialization practices and authority used by teachers. The conceptual framework stems from Baumrind's (1966; 2013) conceptualization of parenting styles, which uses the dimensions of responsiveness and demandingness to classify parenting patterns (Walker, 2008; Wentzel, 2002). Responsiveness is sensitivity to the child's needs, warmth, and respect for the child's autonomy (Walker, 2008). Demandingness includes expectations for behavior and the types of control adults use to achieve socialization goals (Walker, 2008). Within the dimension of demandingness, behavioral control means having developmentally appropriate expectations for children and clearly conveying these expectations through routines and procedures, rules, and limit setting (Viljaranta et al., 2015). On the other hand, psychological control emphasizes obedience and submission to authority, which is accomplished through punitive and coercive practices, including shame and guilt induction (Soenens et al., 2012; Viljaranta et al., 2015).

Teachers can be categorized using these two orthogonal dimensions of responsiveness and demandingness. Authoritative teachers are high on both responsiveness and demandingness. They form warm, supportive relationships with their students and are sensitive to the individual needs of each child, but they also have high expectations for behavior and classroom performance, using clear expectations, routines, and behavioral control to enforce rules and help children meet these expectations (Baker et al., 2009; Ertesvåg, 2011; Walker, 2009). Authoritarian teachers are highly demanding, but because they are low on responsiveness they use pressure and psychologically controlling practices to enforce these rigorous expectations for students (Uibu & Kikas, 2014; Walker, 2008). Permissive teachers are highly responsive, but place too much emphasis on students' autonomy. They have low expectations for students and do not assert any authority or control in the classroom (Uibu & Kikas, 2014; Walker, 2008). This leaves students with a warm relationship with their teacher, but no tools or structure for behavior regulation and academic skill development. Finally, uninvolved teachers are low on

responsiveness and demandingness. This style is characterized by teachers' low effort and expectations, negativity, and low behavioral control (Ertesvåg, 2011; Pellerin, 2005). As discussed in Chapter 2, authoritative, authoritarian, and uninvolved styles were identified in a sample of pre-kindergarten classrooms. In addition, a final style identified in the previous paper was labelled good enough. Interactions in these latter classrooms were average on responsiveness and behavioral control and low on psychological control. Uninvolved style was associated with teachers' lower scaffolding and more traditional child rearing beliefs.

Teacher-Child Interaction Style Related to Academic Skills

Teacher-child interaction style has been related to a number of academic engagement, learning, and achievement outcomes. In her initial study of teaching style in fifth-grade math teachers, Walker (2008) found that students with the permissive teacher showed lower academic gains in math throughout the school year compared to students in both the authoritative classroom and the authoritarian classroom. Further, in one study of first grade students and teachers in Finland, children with authoritative teachers had greater gains in spelling than students in authoritarian-inconsistent classrooms (Kiuru et al., 2012). However, there was no significant difference in reading skills between interaction style groups at the end of first grade.

Very few studies have examined the influence of overall style on math and literacy outcomes, but many studies have examined the importance of responsiveness for student learning. For example, a meta-analysis of student-centered teacher-relationships (characterized by warmth, empathy, self-direction, and flexibly adapting to diverse student needs) revealed moderate associations with cognitive outcomes (Cornelius-White, 2007). Another meta-analysis of teacher-child relationships found that across studies, positive relationships with teachers predicted small to medium associations with achievement outcomes (Roorda, Koomen, Spilt, & Oort, 2011).

Beyond learning outcomes, there is additional evidence that teacher-child interaction style is related to other characteristics (e.g., beliefs, motivations) associated with academic achievement. Walker (2008) found that students in an authoritarian classroom showed

significantly lower academic self-efficacy and higher self-handicapping than students with an authoritative math teacher. In another sample of middle school students, Aldhafri and Alrajhi (2014) found that student perception of teachers' authoritative style predicted increased intrinsic and lower extrinsic math motivation, while authoritarian teaching predicted higher extrinsic math motivation. Although math outcomes were not evaluated in this study, these findings suggest that students with authoritative teachers may develop better internal motivational skills to help them succeed over the long-term. Finally, Baker and colleagues (2009) found that students' ratings of authoritative teaching predicted school satisfaction, self-rated academic competence, and teacher ratings of classroom adjustment. Together these findings suggest that teacher-child interaction style plays an important role in classroom-level processes.

Teacher-Child Interaction Style as Context

While there is some limited empirical evidence that teacher-child interaction style may directly influence academic skills in early childhood, it is likely that teacher-child interaction style indirectly influences academic achievement by moderating the relationship between teaching practices and outcomes. Darling and Steinberg (1993) provide the conceptual framework for parenting styles as the moderator of the relation between parenting practices and adolescent outcomes. They propose that parents use specific practices to achieve socialization goals, but parenting styles act as the context and set the overall tone for the implementation of these practices. Thus, parenting style can alter the effectiveness of practices through the quality of the context in which they are used. Darling and Steinberg (1993) explain that parental involvement in schools is related to greater achievement, but the effect is strongest for authoritative parents because their involvement is more effective than the involvement of other parenting styles.

Walker (2009) applies this conceptual framework to the teaching context. She explains the utility of examining teaching styles as moderators of the relation between teaching practices, student engagement, and learning outcomes. While the effectiveness of some teaching practices is mixed, it may be the teacher-child interaction style context that explains when these practices are

effective at promoting academic achievement outcomes and when they are not (Walker, 2009). Empirical findings from a mixed-methods study of teaching styles reveal that although teachers with varying styles share the same goals for their students, they use different practices to achieve these goals (Walker, 2008). Further, even when the same practices are used to meet instructional goals, students across classrooms with different teaching styles show differences in academic gains (Walker, 2008). Thus, from this perspective it is expected that teaching practices may have inconsistent results when teacher-child interaction style context is not considered. Such inconsistencies are common for data sets in which moderation is operating and moderators have not yet been identified (Baron & Kenny, 1986).

Teaching Practices and Academic Skills

One teaching practice that is often explored in relation to academic outcomes is frequency of instructional activities. Frequency of instruction is conceptualized as the time spent on total instructional activities (Fuller, Bein, Bridges, Kim, & Rabe-Hesketh, 2017) or on specific academic domains or activities (Gerde, Pierce, Lee, & Van Egeren, 2018; Hindman, 2013). Using ECLS-B data, Fuller et al. (2017) found that children who attended preschools with academic orientation (i.e., instructional activities across all academic areas most days of school) had the greatest gains in math and preliteracy skills. Math instruction in pre-kindergarten includes activities such as counting, using manipulatives, measuring, and identifying shapes and patterns (Hindman, 2013; Ritchie, Howes, Kraft-Sayre, & Weiser, 2001). In an analysis of two large data sets, Xue et al. (2016) found that frequency of math instruction was positively related to gains in math skills across pre-kindergarten. However, Hindman (2013) found that higher frequency of math instruction in Head Start classrooms was not significantly related to gains in math knowledge across the pre-kindergarten year.

Frequency of literacy activities is often higher than frequency of math activities in early childhood classrooms (Gerde et al., 2018) and includes a multitude of different activities. Literacy instruction in early childhood includes reading/pre-reading or being read to, sequencing activities,

phonemic awareness, phonics, oral language skills, and writing (Ritchie et al., 2001; Silinskas, Pakarinen, Lerkkanen, Poikkeus, & Nurmi, 2017). Empirical evidence for the influence of frequency of literacy instruction on literacy outcomes is also mixed. Xue et al. (2016) found a positive relationship between literacy instruction frequency and gains in literacy skills in pre-kindergarten. Connor, Son, Hindman, and Morrison (2005) found that time in academics was positively related to letter-word identification and word-attack skills (measured using Woodcock Johnson-revised; Woodcock, Johnson, & Mather, 1990) but not vocabulary in first grade. Further, Silinskas et al. (2017) found that frequency of literacy activities in kindergarten predicted first-grade reading skills for children at-risk for reading problems but not for those who were not at risk.

Another measure of teaching practices is instructional quality. Instructional quality is a broader construct than instructional frequency and is often measured as overarching rather than domain specific (Fuller et al., 2017; Howes et al., 2008). Instructional quality can be defined as the level of support for higher level thinking and problem solving, keeping children engaged in relevant activities, facilitation of learning during activities, and responding and extending knowledge through interaction (Pianta et al., 2008). Empirical findings relating instructional quality to academic outcomes in early childhood are mixed. Hindman (2013) found that CLASS instructional support is positively related to math learning from fall to spring in a Head Start sample. In a sample of public pre-kindergarten and Head Start classrooms, Ryoo, Molfese, and Brown (2018) found that CLASS concept development scores were positively related to growth in math skills, but the CLASS instructional learning formats dimension was not significantly related to growth in math skills. However, Connor et al. (2005) found that classroom environment quality was not significantly related to literacy outcomes in first grade. Similarly, Silinskas et al. (2017) found that instructional support in kindergarten was not significantly related to reading outcomes.

Given the mixed findings outlined in this section, there is reason to believe that these teaching practices are more effective in some classrooms than in others. Teacher-child interaction styles may moderate the effect of teaching practices across classrooms, explaining which conditions these practices are related to children's learning. Although little work has tested this exactly, there have been several studies examining other aspects of teacher-child interactions as moderators. In an integrative review, Sabol and Pianta (2012) outline teacher-child relationships as protective factors for children with academic and demographic risk because they can support social skills and academic learning. Moreover, Cabell and colleagues (2019) found that the classroom organization moderated the effect of book reading on one of their four hypothesized literacy and language outcomes. This provides some evidence of classroom context moderating the relation between practices and learning. Notably, the behavior management aspect of demandingness used in the current study is part of the classroom organization domain used by Cabell et al (2019). It may be that including responsiveness in the measure of classroom contexts helps explain when teaching practices are most effective.

The Current Study

The first goal of this study is to determine whether teacher-child interaction styles are directly related to academic achievement outcomes. Specifically, it is hypothesized that authoritative teacher-child interaction style will predict the greatest gains in literacy and math in pre-kindergarten. The second aim of this study is to explore differences in the influence of teaching practices on academic achievement outcomes across teacher-child interaction styles groups. In other words, teacher-child interaction style will be tested as a moderator of the relationship between teaching practices and academic outcomes.

It is hypothesized that overall instructional quality will be positively related to literacy and math gains from fall to spring. Further, teacher-child interaction style will moderate this relationship, and the effect will be largest in authoritative classrooms. It is also hypothesized that time spent on literacy and math activities will be positively related to literacy and math gains,

respectively, from fall to spring. My final hypothesis is that teacher-child interaction style will moderate the relation between time spent on literacy and math activities and gains in literacy and math outcomes, respectively, and the effect will be largest in authoritative classrooms.

Method

Participants and Procedure

Data for this study are from the public-use data file for the NCEDL Multi-State Study of Pre-Kindergarten and Study of State –Wide Early Education Programs (Early et al., 2013). For detailed sampling and study design information, see Early et al. (2005). Data from 694 lead teachers and 2919 students in these classrooms across 11 states were examined to test the hypotheses. The sample includes classrooms with complete CLASS data and at least one corresponding student. The majority of classrooms have four students, but class size ranges from one to seven due to sampling procedures outlined in Early et al. (2005). In total, 2,515 students participated in fall and spring, 157 participated in fall only, and 247 participated only in the spring. Eight students who moved from one classroom to another classroom at the same site between fall and spring but for whom spring outcome data were still collected were removed from analyses for this study.

Each teacher filled out a demographic questionnaire, several surveys regarding beliefs and practices, and evaluations of each child. Parents filled out a demographic questionnaire for each child, and standardized assessments were used to assess children's academic skills in fall and spring. Trained research assistants conducted observations in each classroom.

Teachers in this study were almost all female (99%). The majority of teachers had a Bachelor's degree (BA/BS) or higher (80%) and about half had both a BA/BS (or better) and a state certificate to teach four year-olds (54%). On average, teachers had 13.23 (*SD* = 9.28) total years of teaching experience with a range of 0 to 60 years.

Children in this study are 49.26% male (*N*= 1438). Child ethnicity was reported as: 41.81% White, 25.99% Latin American, 18.27% African American,2.91% Asian, .74% Native

American, and 10.28% Multiracial. More than half of the families were at or below 150% of the poverty line (N = 1575, 58.2%).

Measures

Teacher-child Interaction Style. Teacher-child interaction styles were measured using five subscales of the CLASS: positive climate, teacher sensitivity, negative climate, behavior management, and overcontrol (Pianta LaParo, & Hamre, 2004). Four teacher-child interaction style categories were identified in Chapter 2 using latent profile analysis: authoritative, good enough, authoritarian, and uninvolved.

Expressive Language skills. The Oral and Written Language Scale- Oral Expression Scale (Carrow-Woolfolk, 1995) measured expressive language skills. In this standardized measure, children are verbally prompted while looking at a picture stimulus board. Then, they are asked to respond by completing a question, sentence, or generating a new sentence. Scores were standardized (M = 100, SD = 15). Cronbach's alpha was .91 in the combined data set. Children were assessed in fall and spring to evaluate growth throughout the pre-kindergarten year.

Math skills. Math skills were measured using the applied problems subtest of the Woodcock-Johnson III Test of Achievement (Woodcock, Mather, & McGrew, 2001). This is a standardized measure of children's ability to solve and analyze math problems (M = 100, SD = 15). Cronbach's alpha in the combined data set was .84. Children completed fall and spring assessments.

Instructional frequency. Time spent on instructional activities was measured using the Emerging Academics Snapshot (Ritchie, Kraft-Sayre, Howes, & Weiser, 2001). For this observational measure, coders rate frequency of children's engagement in 27 areas by observing for 20 seconds and coding for 40 seconds. The cycle is repeated throughout the observation period, with an average of 49.1 cycles (sd = 22.5) per child. The observation period was the entire day in half-day programs and stopped at nap time in full-day programs. The percentage of cycles coded as present was calculated for each child. Frequency of math instruction was operationalized

using the math item from the SNAP. This was coded when the children were engaged in activities such as counting, identifying numerals, graphing, playing math games, identifying and describing shapes, sorting, identifying patterns, measuring, or using a calendar (Ritchie et al., 2001). Mean Kappa in the combined data set was .65 (*sd* = .20) for math. Frequency of literacy instruction was operationalized using the following items: child read to (*K* = .94, *sd* = .09), child pre-reading (*K* = .68, *sd* = .39), and oral language development (*K* = .59, *sd* = .21) items. Child read to was coded any time the teacher was reading a book or asking questions about a book. Pre-reading was coded when children were reading alone or with other children, listening to a book on tape, or sequencing events in stories. Oral language development was coded when teachers asked questions, helped children express feelings and thoughts, and helped children learn or practice new vocabulary.

Instructional quality. The CLASS instructional climate factor (Pianta et al., 2004) was used to measure instructional quality. This factor is comprised of the concept development and quality of feedback dimensions. Concept development refers to teachers' use of strategies to promote higher level thinking, problem-solving, and creativity. Quality of feedback includes the quality of teachers' comments on children's work and ideas. Each classroom had one overall score ranging from one to seven. In the combined data set, mean weighted Kappa was .65 (*sd* = .10).

Covariates. Consistent with previous studies of math and literacy development in early childhood (Silinskas et al., 2017) several teaching and classroom covariates were considered. Child covariates reported by parents on the demographic questionnaire include child sex and family income. Family income was dichotomized as at or below 150% of the federal poverty level. Classroom level covariates include child to teacher ratio and teacher education. The ratio of children present in the class to staff was calculated as part of the Early Childhood Environment Rating Scale-Revised (ECERS-R; Harms, Clifford, & Cryer, 1998). Teacher education was rated

from 1 (High School) to 7 (Doctorate). Descriptive statistics for these items are presented in Table 5.

Analytic Strategy

To prepare data for analyses, the public-use versions of classroom- and child-level data files were downloaded from the Inter-university Consortium for Political and Social Research website (ICPSR, Early et al., 2013). The files were merged in Stata 14.2 (StataCorp, 2015) using the ICPSR_CLASS_ID variable, which is the unique identifier for each classroom. While investigating the sample characteristics and missing data patterns, it was discovered that the numbering for this ID variable was off by one between the two datasets starting with ICPSR_CLASS_ID 543 (classroom-level dataset) and 544 (child-level dataset).

It appears that one student in classroom 542 moved classrooms during the school year and was assigned to classroom 543 (variable name ICPSR_SITE_PS). Changes between fall and spring classrooms occurred for seven other students in the dataset. In six of these cases, an additional classroom was created in the classroom-level dataset to correspond with the student's new classroom, even though most of the data for these classrooms were not collected and are missing from the dataset. In the case of classroom 543, the classroom-level data file has complete data, which is unexpected for a classroom in which the student moved during the school year. It appears that the data for ICPSR_CLASS_ID 543 in the dataset actually corresponds to students with ICPSR_CLASS_ID 544 in the child-level dataset. It also appears that the numbering continues to be off by one for all children in the classroom-level dataset in classrooms 544 through 722. There are few variables that are the same across the two datasets. However, the STATE is the same across the two datasets. Examination of this variable reveals that the switch from state 11 to 12 occurs in classroom 424 in both datasets, but the switch from state13 to state 14 occurs in classroom 620 in the classroom-level dataset and in classroom 621 in the child-level dataset. To fix the problem, the ICPSR_CLASS_ID was adjusted by subtracting one from all children in classrooms 544 to 722. To check that the correct students were matched with the

correct classrooms, we calculated the average among children in each classroom for each of the 27 SNAP items. This calculated value was compared to the corresponding classroom average variable in the classroom-level dataset. All values were within the range that is reasonable to expect with differences due to rounding, so students appear to be matched with the correct classrooms. Finally, one student (i.e., ICPSR_STUDY_ID 548) either moved from one study classroom to another study classroom at a different site between fall and spring, or there is an error in coding the classroom ID. This student was removed from analyses.

In Manuscript 1, latent profile analysis was used to identify categories of teacher-child interaction styles, which were used to test hypotheses in the current paper using a series of latent variable mixture models. General mixture models (GMM) contain two parts: a measurement model and a structural model (Muthén & Muthén, 2012). For each of the mixture models in this study, the LPA from Manuscript 1 using a manual 3-step estimation procedure, as outlined by Asparouhov and Muthén (2014) serves as the measurement portion of the model. All models were tested using *M*plus 8.1 (Muthén & Muthén, 1998-2018). In the first step, the LPA model from Manuscript 1 was used to save a variable for most likely class membership (teacher-child interaction style category) and the probability of class membership was saved to account for measurement error in subsequent analyses (step 2). In the third step the saved variables from steps 1 and 2 were used to test distal outcomes of the latent classes with covariates by employing a series of multilevel mixture regression models (Asparouhov & Muthén, 2014). Full information maximum likelihood (FIML) estimation was used to account for missing data in all models. This method uses all available variances and covariances to estimate the model, so no information is left out, even if some data is missing (Acock, 2012). To use this method, it is assumed that data is Missing at Random (MAR)—that missing data can be explained by an observed variable that can be included in the model.

The aims of this study are to examine gains in math and language skills across teacher-child interaction style categories, and to assess styles as a moderating context for the development

of these skills. To test this, two multilevel mixture regression models were developed. To prepare variables for the models, several variable transformations were used. In order to aid in interpretation of intercepts in the multilevel models, all predictor variables were centered using the sample mean for available data. Next, variables separating variability at the within-level and between-level were calculated for child-level variables: fall math and language scores; child sex; whether family was low-income; and time spent on math, oral language, book reading, and pre-reading activities. To do this, cluster means for each variable were computed and saved for the between-level variable. Then, the difference of the individual child's score from the cluster mean was saved as the within-level variable (Raudenbush & Bryk, 2002).

Results

Descriptive statistics for the total sample are presented in Table 5, and correlations between study variables are in Table 6. However, these tables do not include estimated values for missing data, so they do not represent all information included in the models used to test the hypotheses. The intraclass correlation (ICC) for math scores was .22, suggesting that 22% of the variance in spring math scores, controlling for fall scores, was between classrooms. The ICC for expressive language was .24. Both outcomes have a significant portion of variance between classrooms, confirming the need for multilevel models.

Differences in Learning Outcomes

The first goal of this study was to examine gains in math and literacy learning across teacher-child interaction style categories. The first multilevel latent regression model was developed to test the effect of teacher-child interaction styles on math learning. Results of this regression are presented in Table 7, and estimated means and variance for the variables are in Table 8. The overall effect of teacher-child interaction style on math learning was evaluated by testing significant differences in parameter estimates of the intercepts for each of the groups using the delta method to calculate standard errors. As reported in Table 7, students in the authoritative and good enough profiles had significantly higher average spring math scores than students in

uninvolved classrooms, controlling for demographic characteristics, fall math scores, and teaching practices. Students in authoritative classrooms also had significantly higher average spring math scores than students in authoritarian classrooms, and the difference between authoritarian and good enough classrooms was trending toward significance. Spring math scores did not differ between authoritative and good enough or between authoritarian and uninvolved.

The second multilevel mixture regression model predicted expressive language learning outcomes across all four teacher-child interaction style groups (see Table 9). Estimated means and variance are reported in Table 10. Again, significant differences in parameter estimates for the intercepts were tested. Results reveal that only uninvolved and good enough groups significantly differed on spring expressive language. On average, students in the good enough classrooms were 1.62 points higher on expressive language than students in uninvolved classrooms.

Teacher-child Interaction Style as Moderator

The second goal of this study is to test teacher-child interaction style as a moderator of the relation between teaching practices and academic outcomes. First, two multilevel regression models were run to examine the main effect of teaching practices on learning, regardless of teacher-child interaction style. Results for teacher practices predicting math are in Table 11 and expressive language are in Table 12. Time spent on math activities was significantly related to higher spring math scores at the between level (B = .11, p = .01), and the effect within classrooms was marginally significant (B = .09, p = .06). Higher quality instructional climate predicted significantly higher math scores between classrooms (B = .74, p = .01). For expressive language, better instructional climate was also significantly related to higher spring scores between classrooms (B = 1.40, p < .001). Frequency of oral language practices was negatively related to expressive language scores between classrooms (B = -.14, p = .001), but effect of the frequency of all other practices was not significant.

Next, the regression coefficients for teaching practices (i.e., time and instructional climate) were compared across profiles in the multilevel mixture regression models discussed in the previous section to test whether teacher-child interaction style moderates the effect of teaching practices on learning outcomes. Results for math are reported in Table 7. There was some support for this hypothesis. Time spent on math was significantly related to spring math scores only in classrooms with authoritative teacher-child interaction style. Within these authoritative classrooms, children who spend more time on math activities had significantly higher math learning from fall to spring. The effect of frequency of math activities on math learning was marginally significant between classrooms for the authoritative profile, and was not significant for the other three profiles. There were differences between profiles in the effect of classroom instructional climate on spring math scores. Instructional climate significantly predicted math scores only for the good enough group.

Two findings suggest that teacher-child interaction style acts as a moderating context for math learning by altering the effect of demographic covariates in the model. Family income was negatively related to math scores for students in good enough classrooms at the within- and between-level. It was not significantly related to math learning in other styles. Within classrooms, boys also had lower average spring math scores than girls in the good enough profile, but there were no significant gender differences in other styles.

Next, teaching practices predicting expressive language were tested across all four profiles. As shown in Table 9, differences in time spent on oral language development between classrooms were *negatively* related to expressive language scores for uninvolved and authoritative profiles, and the effect was marginally significant in the good enough profile. Proportion of time spent in shared book reading and pre-reading activities was not significantly related to expressive language at the within- or between-level for any of the groups. Instructional climate was significantly related to expressive language scores only for the authoritative and good enough

profiles.. However, results of parameter estimate comparisons reveal that there were no significant differences in the coefficients for instructional climate between any of the four groups.

Discussion

The current study builds on previous work to examine early learning outcomes across teacher-child interaction style groups. Test of Hypothesis 1 reveals some significant differences in math skills between style groups at the end of pre-kindergarten. On average, students in authoritative and good enough classrooms have higher standardized math scores than students in authoritarian and uninvolved. The findings support the hypothesis that teacher-child interactions styles are directly related to math outcomes. However, results provide less support for a relationship between teacher-child interaction style and expressive language. Surprisingly, children's expressive language outcomes were fairly consistent across all four profiles, with differences only between uninvolved and good enough.

Results in this study provide support for the hypothesis that teaching practices are moderated by teacher-child interaction styles. The main effect of frequency of math activities was significant between classrooms and marginally significant within classrooms. However, when examining this effect by teacher-child interaction style, results suggest frequency of math activities are only significantly related to math learning in authoritative classrooms. Likewise, the overall effect of instructional climate is significant only in good enough classrooms. Together these findings suggest that teaching practices are more effective in authoritative and good enough classrooms than authoritarian and uninvolved classrooms.

Overall, the hypothesis that teaching practices were more effective for language outcomes in authoritative classrooms than in other groups of teacher-child interaction style was not supported. Generally, time spent on oral language development, shared book reading, and pre-reading activities were not associated with gains in expressive language from fall to spring in pre-kindergarten. These findings are consistent with results from a recent study examining language development in pre-kindergarten, which found that growth in expressive language skills

was not significantly related to time participating in vocabulary or oral language activities (Bratsch-Hines, Burchinal, Peisner-Feinberg, & Franco, 2019). However, in this study, children who spent less time in large group settings had higher expressive language scores. It may be that large versus small group setting is an important variable to include in future analyses.

Other qualities of language instruction may also explain these findings. Perhaps the subject-specific quality of teaching practices must also be evaluated. For example, Cabell et al. (2019) found that quality of book reading, evaluated based on types of talk and questioning, predicted gains in pre-kindergarten children's language ability. Operationalization of teaching practices in this study included proportion of time, without any indication of quality within those codes. Another area to explore may be the influence of play on children's expressive language development. In an intervention to increase the effectiveness of vocabulary instruction, Han, Moore, Vukelich, and Buell (2010) found that children receiving a vocabulary instruction intervention that included play had higher expressive language scores after the intervention and had a significantly steeper trajectory of learning over time. As explained by Han et al. (2010) guided play is a developmentally appropriate way for children to learn and practice literacy skills. A more recent study found that children showed significant gains in expressive language when they participated in a different vocabulary plus play intervention that focused on adult support of vocabulary review during the play session (Toub et al., 2018). Future studies should investigate whether teacher-child interaction style is related to play in the classroom and how teachers' guidance and involvement across styles during play relates to learning.

The finding that time spent on oral language development was negatively related to expressive language learning in authoritative classrooms was the opposite of the expected effect. According to the measure this activity is coded when teachers are involved with the child trying to get them to communicate and build expressive language through questions, expanding on children's thoughts, helping children problem-solve or resolve conflict, verbal social interaction, or helping child practice vocabulary (Ritchie et al., 2001). It may be the case that children with

lower expressive language ability elicit this type of interaction with teachers. Authoritative teachers are more attuned to students' individual needs, so one explanation for these results may be that they spend more time on oral language development with students who are struggling. Another potential explanation is that Ritchie et al. (2003) suggest that the oral language development code is often used for teacher interaction with second language learners, which was not accounted for in the current models.

It is important to note that there were estimated mean differences between groups across study variables. Children in authoritative classrooms spent significantly more time in math and literacy activities, and instructional climate was higher in authoritative classrooms. For most variables, practices in the good enough profile were also significantly better than authoritarian and uninvolved. Although this did not seem to have an impact on outcomes in the current study, these practices may lay the foundation for learning and academic outcomes in later elementary school. Further, it may also be important to examine the impact of teacher-child interaction style on other outcomes, such as self-regulation, motivation, and behavior. Others have found links between interaction style and classroom engagement (e.g., Baker et al., 2009). Likewise, these skills have been shown to be related to learning outcomes. For example, Bohlmann and Downer (2016) found that self-regulation was positively related to literacy and language outcomes, and that task engagement mediated this link. Thus, self-regulation and task engagement may be two ways that teacher-child interaction style may influence early learning.

Strengths, Limitations, and Directions for Future Research

Although only some hypotheses were supported, , there are several important contributions of this study. The current analyses made it possible to investigate teacher-child interaction style as context. Multilevel mixture regression and partitioning of variability evaluated differences in effects within and between classrooms. In this study we were able to examine the influence of overall teaching practices across classrooms and the effect on individual students within the classroom. Results provided evidence that teacher-child interaction style moderates the

relation of some variables within and between classrooms. Future work should extend these findings to compare differences in how teacher-child interaction style predicts learning for children from different groups (e.g., interaction with gender; racial/ethnic background; dual language learners).

Some limitations must be recognized. First, the number of classrooms characterized by authoritarian teacher-child interaction style is quite small, containing approximately 5% of the total sample. Although the overall sample was large, the smaller number of classrooms with the authoritarian profile may have limited the ability to find significant effects. Future work may benefit from utilizing purposive sampling to better understand the dynamic interplay among teaching practices and teacher-child interaction in authoritarian classrooms. Second, the scope of teaching practices observed in this sample is very narrow. Observations took place for only on one or two days. Additionally, instructional climate and time spent on target activities were the only practices hypothesized to influence learning. Other practices such as type of activity setting (e.g., whole group, small group, individual, whether activity is free-choice or teacher directed, and other subject areas (e.g., science, social studies, art).

Finally, timing of data collection limits causal inferences. While fall and spring scores were available for outcome measures, CLASS and SNAP observations were not. In half of the sample, CLASS scores are based on averages of fall and spring observations and observations were only conducted in the spring for the other half of the sample. Future work should examine stability of teacher-child interaction styles and teaching practices across the school year and longitudinal effects on academic skills trajectories.

Conclusion

The findings in the current study provide some evidence teacher-child interaction styles are linked to children's learning. Overall, children in authoritative and good enough classrooms showed more gains in math learning, and teaching practices predicted greater gains for children in classrooms with these interaction styles. Findings also reveal differences in use of teaching

practices across styles. Future work is needed to explore how teacher-child interaction style influences other teaching practices and examine links to additional learning and behavioral outcomes.

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CHAPTER IV

CONCLUSION

The study of interactions between teachers and students has become an important facet of evaluation and research. The current study aimed to extend empirical work on teacher-child relationships and classroom quality in early childhood by applying the parenting styles framework to classroom interactions. The contribution of this framework is the emphasis on looking at teachers' responsiveness and sensitivity categorically coupled with demandingness and high expectations. As proposed, the current study was able to identify teacher-child interaction styles consistent with this framework and explore their relation to student learning.

Summary of Manuscript 1

The purpose of Manuscript 1 was to explore a new approach for operationalizing teacher-child interaction styles using the CLASS. By looking at teachers' responsiveness and sensitivity categorically coupled with demandingness and high expectations we hoped to better explain the different styles of interaction that emerged in classrooms. Findings in this study suggest that patterns similar to those identified in the parenting styles literature emerged across classrooms: authoritative, authoritarian, and uninvolved. A fourth group, good enough, that is less often described in the literature also emerged. The use of scaffolding practices and teacher beliefs as predictors of styles provided some initial validation that the CLASS was adequately measuring responsiveness and demandingness.

Summary of Manuscript 2

To extend initial findings identifying teacher-child interaction styles, Manuscript 2 sought to examine the relation between these styles and student learning. Results revealed that students had greater gains in math scores across pre-kindergarten when they were in authoritative and good enough classrooms than when they were in uninvolved and authoritarian. However, there were no differences across styles for expressive language. The second aim of this study was to test whether teaching practices varied in effectiveness across teacher-child interaction styles. While the instructional frequency and climate were generally higher in authoritative and good enough profiles than uninvolved and authoritarian profiles, the findings did not suggest that the effect of these practices substantively differed across the four style groups as expected.

Connections Between the Two Manuscripts

Together these findings provide support for the examination of the influence of teacher-child interaction style and suggest that the CLASS is a tool that can be used to measure this construct in future studies. Findings from both papers suggest that there are demographic differences across style groups, as well as differences in teaching practices. Because these were only related to small differences in math learning outcomes, future studies are needed to examine the effect of teacher-child interaction styles on children's motivational and behavioral outcomes (e.g., classroom engagement, self-regulation). Finally, future work is needed to first replicate and further validate the use of the CLASS as a measure responsive and demanding teacher-child interaction styles. There is still much work that needs to be done to understand complex teacher-child interactions, but the use of the current widespread use of the CLASS may make this task more accessible for future investigation.

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APPENDICES

APPENDIX A

TABLES

Table 1.
Descriptive statistics for Teacher and Classroom Characteristics

Variable	*n*	*%*	*M*	*SD*	Min	Max	% Missing
Teacher							
Scaffolding	694		8.83	6.68	0	39	0%
Traditional Beliefs	662		37.05	9.47	16	64	4.6%
Education	679		4.25	1.42	1	7	2.2%
State Pre-K Certificate	666						4%
yes	380	54.8%					
no	286	41.2%					
CDA	628						9.5%
yes	112	16.1%					
no	516	74.4%					
Ethnicity	665						4.2%
White	451	65%					
Latina	90	13%					
Black, other, multiple	124	17.9%					
Classroom							
Location	694						0%
In Public School (PS)	392	56.5%					
In Head Start (HS)	67	9.7%					
In HS and PS	40	5.8%					
Neither	195	28.1%					
Full day program	654						5.8%
yes	299	43.1%					
no	395	56.9%					
Child-staff ratio	693		8.66	3.56	2.17	29	<.01%
Maternal education	694		12.8	1.38	9.25	19	0
% Poor	694		58.3	31.99	0	100	0
% Male	643		51.56	11.49	19	89	0
% White	694		41.27	37.34	0	100	0
% Black	694		17.74	28.99	0	100	0
% Native American	694		.75	4.28	0	71	0
% Latino	694		26.8	34.93	0	100	0
% Asian	694		3.37	9.27	0	57	0
% Other, multiple races	694		9.77	11.69	0	75	0

Note. Percentages may not sum to 100% due to rounding. CDA= Child Development Associate

Table 2

LPA model-fit statistics and group sizes

Number of Profiles	AIC	BIC	aBIC	VLMR	LMR	bootstrap	entropy	Group sizes
1	8606.60	8652.03	8620.27					694
2	7554.57	7627.25	7576.45	<.001	<.001	<.001	.886	537, 157
3	7101.01	7200.94	7131.09	.175	.180	<.001	.833	61, 304, 329
4	**6829.21**	**6956.40**	**6867.49**	**.015**	**.016**	**<.001**	**.841**	**156, 364, 141, 33**
5	6739.31	6893.75	6785.80	.404	.411	<.001	.860	34, 138, 362, 153, 7

Note. AIC= Akaike's Information Criterion, BIC= Bayesian Information Criterion, aBIC= and the adjusted Bayesian Information Criterion, VLMR= Vuong-Lo-Mendell-Rubin likelihood ratio test, LMR= adjusted Lo-Mendell-Rubin test, bootstrap= bootstrap likelihood ratio test

Table 3.
Means for full sample and by profile on the 5 dimensions of the CLASS

CLASS Dimensions	Full Sample (n = 694)	Authoritarian (n = 33)	Uninvolved (n = 141)	Authoritative (n = 156)	Good Enough (n = 364)
Positive Climate	5.28	3.38	4.46	6.23	5.34
Teacher Sensitivity	4.70	2.87	3.79	5.83	4.73
Behavior Management	4.97	3.57	4.06	5.96	5.01
Overcontrol	1.59	3.01	1.99	1.30	1.43
Negative Climate	1.55	3.60	2.05	1.17	1.34

Note. All profiles differed at $p < .05$; CLASS = Classroom Assessment Scoring System

Table 4.
Odds ratios from multinomial logistic regressions predicting profile membership from teacher and classroom characteristics

	Good Enough vs. Authoritative		**Authoritarian vs. Authoritative**		**Uninvolved vs. Authoritative**		**Uninvolved vs. Good Enough**		**Authoritarian vs. Good Enough**		**Authoritarian vs. Uninvolved**	
	OR	***SE***	***OR***	***SE***	***OR***	***SE***	***OR***	***SE***	***OR***	***SE***	***OR***	***SE***
Teacher												
Scaffolding	.89***	.02	.68***	.07	.76***	.04	.85***	.03	.77***	.07	.90	.07
Traditional beliefs	1.01	.02	1.08**	.03	1.08***	.02	1.07***	.02	1.08**	.03	1.00	.03
Education	1.10	.17	2.33**	.30	1.19	.21	1.09	.18	2.12**	.27	1.96*	.27
State Certificate	1.46	.38	1.16	.69	2.19	.46	1.50	.37	.80	.63	.53	.63
Education X certificate	1.08	.27	.72	.49	.86	.33	.80	.26	.66	.44	.83	.45
CDA	2.41*	.42	6.49*	.86	3.48*	.50	1.44	.42	2.69	.80	1.86	.80
Ethnicity												
Latino	2.52	.56	2.21	1.08	1.02	.64	.41	.52	.88	.99	2.17	1.00
Black, other, multiple	1.07	.46	.82	.76	.65	.54	.61	.43	.77	.66	1.25	.68
Classroom												
In Public School (PS)	.74	.36	.80	.70	.66	.43	.89	.36	1.08	.65	1.21	.65
In Head Start (HS)	1.03	.57	2.43	.92	.97	.66	.94	.52	2.35	.80	2.49	.80
In HS and PS	1.34	.78	2.21	1.23	2.09	.85	1.56	.59	1.65	1.05	1.06	1.01
Full day program	1.11	.34	2.90	.62	2.80**	.40	2.52**	.32	2.61	.56	1.04	.57
Child-staff ratio	1.18***	.05	1.06	.08	1.11	.06	.94	.04	.89	.07	.95	.07
Maternal education	.89	.14	.64	.32	.70*	.18	.79	.15	.72	.30	.90	.31
% Poor	1.01*	.01	1.01	.01	1.02	.01	1.00	.01	1.00	.01	1.00	.01
% Male	1.01	.01	1.03	.02	1.01	.02	1.00	.01	1.01	.02	1.01	.02
% Black	1.01	.01	1.04**	.01	1.02	.01	1.01	.01	1.03**	.01	1.02*	.01
% Native American	.99	.03	.31	9.77	.98	.05	1.00	.05	.31	9.77	.31	9.78
% Latino	.98*	.01	.99	.01	1.00	.01	1.01*	.01	1.01	.01	1.00	.01
% Asian	1.01	.01	1.03	.04	1.02	.02	1.00	.02	1.02	.04	1.01	.04
% Other, Multiple Races	.99	.01	1.02	.03	1.02	.01	1.03*	.01	1.03	.03	1.00	.03

Note. CDA = Child Development Associate; *$p < .05$, **$p < .01$, ***$p < .001$

Table 5.
Descriptive Statistics for Study Variables

Variable	*n*	%	*M*	*SD*	Min	Max
Child-level						
Sex	2919					
Male	1438	49.3%				
Female	1481	50.7%				
Family Low Income	2706					
Yes	1575	54.0%				
No	1131	38.7%				
SNAP Math	2735		8.07	6.41	0	44
SNAP Oral Language	2735		5.66	5.50	0	45
SNAP Book Reading	2735		5.08	4.65	0	36
SNAP Preread	2735		3.22	4.16	0	36
Fall Math	2241		98.45	13.70	46	139
Spring Math	2405		99.15	12.87	44	151
Fall Expressive Language	2249		91.51	13.11	52	146
Spring Expressive Language	2406		93.68	13.01	53	142
Classroom-level						
Teacher Education	679		4.24	1.41	1	7
Child-teacher Ratio	693		8.68	3.61	2.17	29
CLASS Instructional Climate	694		2.07	.84	1	5.19

Note. Some percentages do not sum to 100% due to missing data.

Table 6.
Correlations Between Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Child Sex: Male	—												
2. Family Low Income	-.01	—											
3. Teacher Education	-.01	-.06**	—										
4. Child-teacher Ratio	-.02	-.04**	.18***	—									
5. SNAP Math	.01	-.04	.15***	.07***	—								
6. SNAP Oral Language	.02	.02	.11***	.02	.10***	—							
7. SNAP Pre-reading	-.03	.00	.04*	.04*	.05*	.10***	—						
8. SNAP Book Reading	.03	-.05**	.11***	.01	.09***	.16***	.16***	—					
9. Instructional Climate	.01	-.03	-.09**	-.25***	.05**	.18***	.00	.04*	—				
10. Fall Math	-.07**	-.29***	.03	-.03	.06**	.00	.02	.06**	.10***	—			
11. Spring Math	-.08**	-.27***	.02	.00	.10***	-.01	.06**	.06**	.11***	.72***	—		
12. Fall Expressive Language	-.12**	-.26***	.01	-.09***	.02	.01	.05*	.03	.13***	.60***	.57**	—	
13. Spring Expressive Language	-.11**	-.28***	-.03	-.06**	.01	-.02	.03	.02	.17***	.59**	.59**	.78**	—

Note. Pairwise deletion; *$p < .05$, **$p < .01$, *** $p < .001$

Table 7.
Multilevel Mixture Regression for Spring Math

	1. Authoritarian (*n* = 172)			2. Uninvolved (*n* = 611)			3. Authoritative (*n* = 674)			4. Good Enough (*n* = 1462)		
	Est.	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**
Within-level												
Fall Math	.67***	.08		.62***	.04		.64***	.04		.64***	.03	
Sex: Male	-.78	1.62		-1.35	.99		-.79	.85		-1.23*	.59	
Family Low Income	-.42	2.22		-.35	1.17		-.47	1.36		-1.89*	.82	
SNAP Math	.03	.23		.07	.13		.26**	.09	4	.00	.08	3
Residual Variance	69.35***	2.46		69.35***	2.46		69.35***	2.46		69.35***	2.46	
Between-Level												
Fall Math	.55***	.15		.59***	.08		.58***	.06	4†	.64***	.05	3†
Sex: Male	9.20	6.04	4†	.07	3.09		-.40	3.20		-1.84	2.18	1†
Family Low Income	2.19	3.87		-3.06	1.92		-2.22	1.47		-3.05**	1.13	
Teacher Education	1.06	.77		-.15	.42		-.03	.34		-.19	.27	
Child Ratio	-.19	.36		-.06	.17		.19	.26		.14	.10	
SNAP Math	-.23	.32		.16	.12		.17†	.10		.06	.07	
Instructional Climate	.09	1.64		.08	1.14		-.18	.53	4†	1.22*	2.39	3†
Residual Variance	11.21***	2.24		11.21***	2.24		11.21***	2.24		11.21***	2.24	
Intercept	96.34***	1.74	3, 4†	97.72***	.73	3, 4	100.42***	.73	1, 2	99.61***	.36	1†, 2

Note. Est. = estimate; SE = standard error; Diff at $p < .05$ means that parameter estimates significantly differ from listed groups at $p < .05$.
*$p < .05$, **$p < .01$, ***$p < .001$, †$p < .10$

Table 8.
Predicted Means and Variance for Math Model

	1. Authoritarian (*n* = 172)			2. Uninvolved (*n* = 611)			3. Authoritative (*n* = 674)			4. Good Enough (*n* = 1462)		
	Est.	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**
Within-level												
Means												
Fall Math	-.30	.22		-.30	.22		-.30	.22		-.30	.22	
Sex: Male	.00	.01		.00	.01		.00	.01		.00	.01	
Family Low Income	.00	.01		.00	.01		.00	.01		.00	.01	
SNAP Math	.00	.07		.00	.07		.00	.07		.00	.07	
Variance												
Fall Math	111.56***	3.40		111.56***	3.40		111.56***	3.40		111.56***	3.40	
Sex: Male	.23***	.01		.23***	.01		.23***	.01		.23***	.01	
Family Low Income	.12***	.00		.12***	.00		.12***	.00		.12***	.00	
SNAP Math	13.88***	.38		13.88***	.38		13.88***	.38		13.88***	.38	
Between-Level												
Means												
Fall Math	-6.13***	1.45	2, 3, 4	-2.75***	.78	1, 3, 4	2.90***	.80	1, 2, 4	.27	.55	1, 2, 3
Sex: Male	.01	.03		.00	.02		.00	.01		.00	.01	
Family Low Income	.17**	.06	3, 4	.08**	.03	3, 4	-.07*	.03	1, 2	-.02	.02	1, 2
Teacher Education	.22	.23		-.16	.13	4†	-.17	.13	4†	.14	.09	2†, 3†
Child Ratio	-.42	.53	4†	.03	.30	3	-1.12***	.27	2, 4	.60**	.20	1†, 3
SNAP Math	-1.47†	.82	3, 4†	-1.45**	.46	3, 4	1.02*	.47	1, 2	.24	.32	1†, 2
Instructional Climate	-.47***	.12	3, 4	-.40***	.06	3, 4	.63***	.27	1, 2, 4	-.09†	.05	1, 2, 3
Variance												
Fall Math	73.91***	4.03		73.91***	4.03		73.91***	4.03		73.91***	4.03	

Sex: Male	.03***	.00	.03***	.00	.03***	.00	.03***	.00
Poor	.12***	.01	.12***	.01	.12***	.01	.12***	.01
Teacher Education	1.96***	.11	1.96***	.11	1.96***	.11	1.96***	.11
Child Ratio	10.81***	.59	10.81***	.59	10.81***	.59	10.81***	.59
SNAP Math	26.25***	1.42	26.25***	1.42	26.25***	1.42	26.25***	1.42
Instructional Climate	.55***	.03	.55***	.03	.55***	.03	.55***	.03

Note. Est. = estimate; SE = standard error; Diff at $p < .05$ means that parameter estimates significantly differ from listed groups at $p < .05$.
*$p < .05$, **$p < .01$, ***$p < .001$, $^{\dagger}p < .10$

Table 9.
Multilevel Mixture Regression for Spring Expressive Language

	1. Authoritarian (*n* = 154)			2. Uninvolved (*n* = 630)			3. Authoritative (*n* = 645)			4. Good Enough (*n* = 1490)		
	Est.	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**
Within-level												
Fall Expressive Language	.79***	.08		.76***	.04		.72***	.04		.71***	.03	
Sex: Male	-.10	1.59		-2.09*	.85	4†	-.82	.80		-.24	.55	2†
Family Low Income	-1.30	2.10		-1.20	1.11		.07	1.30		-1.73*	-2.27	
SNAP Oral Language	.26	.29		.05	.76		.01	.10		.02	.09	
SNAP Book Reading	-.07	.42		-.09	.22		.03	.16		.08	.13	
SNAP Pre-reading	.24	.30		-.23	.17		.01	.12		.08	.11	
Residual Variance	60.80***	2.03		60.80***	2.03		60.80***	2.03		60.80***	2.03	
Between-Level												
Fall Expressive Language	.89***	.12	2†	.64***	.06	1†, 4†	.71***	.05		.77***	.04	2†
Sex: Male	-.49	5.59		-.76	2.34		2.21	2.58		-1.59	1.78	
Family Low Income	-5.77†	2.96		-4.37**	1.48		-4.79***	1.16	4	-1.68†	.91	3
Teacher Education	-.03	.65		-.53†	.31		-.34	.30		-.24	.23	
Child Ratio	-.03	.28		-.07	.13		.16	.26		.16†	.08	
SNAP Oral Language	.31	.22	2, 3, 4†	-.42**	.15	1, 4†	-.17*	.08	1	-.12†	.06	1†, 2†
SNAP Book Reading	-.35	.27		.00	.13		-.07	.09		.06	.07	
SNAP Pre-reading	-.05	.30		.08	.17		.04	.11		.05	.10	
Instructional Climate	.86	1.30		1.03	.90		1.32**	.46		2.16***	.54	
Residual Variance	1.49*	.66		1.49*	.66		1.49*	.66		1.49*	.66	
Intercept	93.19***	1.29		92.79***	.63	4	93.50***	.71		94.41***	.32	2

Note. Est. = estimate; SE = standard error; Diff at $p < .05$ means that parameter estimates significantly differ from listed groups at $p < .05$.
*$p < .05$, **$p < .01$, ***$p < .001$, †$p < .10$

Table 10.
Predicted Means and Variance for Expressive Language Model

	1. Authoritarian (*n* = 154)			2. Uninvolved (*n* = 630)			3. Authoritative (*n* = 645)			4. Good Enough (*n* = 1490)		
	Est.	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**	**Est.**	**SE**	**Diff. at *p* < .05**
Within-level												
Means												
Fall Expressive Language	-.43*	.21		-.43*	.21		-.43*	.21		-.43*	.21	
Sex: Male	.00	.01		.00	.01		.00	.01		.00	.01	
Family Low Income	.00	.01		.00	.01		.00	.01		.00	.01	
SNAP Oral Language	.00	.06		.00	.06		.00	.06		.00	.06	
SNAP Book Reading	.00	.04		.00	.04		.00	.04		.00	.04	
SNAP Pre-reading	.00	.05		.00	.05		.00	.05		.00	.05	
Variance												
Fall Expressive Language	101.92***	3.08		101.92***	3.08		101.92***	3.08		101.92***	3.08	
Sex: Male	.23***	.01		.23***	.01		.23***	.01		.23***	.01	
Family Low Income	.12***	.00		.12***	.00		.12***	.00		.12***	.00	
SNAP Oral Language	8.51***	.23		8.51***	.23		8.51***	.23		8.51***	.23	
SNAP Book Reading	4.32***	.12		4.32***	.12		4.32***	.12		4.32***	.12	
SNAP Pre-reading	6.56***	.18		6.56***	.18		6.56***	.18		6.56***	.18	
Between-Level												
Means												
Fall Expressive Language	-2.64†	1.40	3	-3.19***	.72	3, 4	3.40***	.77	1, 2, 4	-.25	.51	2, 3
Sex: Male	-.02	.03		.01	.01		.01	.01		-.01	.01	
Family Low Income	.11†	.06	3, 4†	.08*	.03	3, 4	-.07*	.03	1, 2	-.01	.02	1†, 2

Teacher Education	.59*	.24	2, 3	-.37**	.12	1, 4	-.30*	.13	1, 4	.24**	.09	2, 3
Child Ratio	.09	.57	3	-.05	.29	3, 4†	-1.30***	.28	1, 2, 4	.61**	.20	2†, 3
SNAP Oral Language	-1.40†	.76	3, 4†	-1.85***	.38	3, 4	1.76***	.43	1, 2, 4	.08	.27	1†, 2, 3
SNAP Book Reading	-1.33†	.70	3, 4	-1.15**	.35	3, 4	.59	.38	1, 2	.37	.25	1, 2
SNAP Pre-reading	.10	.56		-.44	.28	3	.42	.30	2	-.02	.20	
Instructional Climate	-.47***	.12	3, 4	-.41***	.06	3, 4	.77***	.08	1, 2, 4	-.14**	.05	1, 2, 3
Variance												
Fall Expressive Language	.50***	.03		.50***	.03		.50***	.03		.50***	.03	
Sex: Male	.03***	.00		.03***	.00		.03***	.00		.03***	.00	
Poor	.13***	.01		.13***	.01		.13***	.01		.13***	.01	
Teacher Education	1.89***	.10		1.89***	.10		1.89***	.10		1.89***	.10	
Child Ratio	10.72***	.58		10.72***	.58		10.72***	.58		10.72***	.58	
SNAP Oral Language	20.04***	1.09		20.04***	1.09		20.04***	1.09		20.04***	1.09	
SNAP Book Reading	16.80***	.90		16.80***	.90		16.80***	.90		16.80***	.90	
SNAP Pre-reading	10.82***	.58		10.82***	.58		10.82***	.58		10.82***	.58	
Instructional Climate	.50***	.03		.50***	.03		.50***	.03		.50***	.03	

Note. Est. = estimate; SE = standard error; Diff at $p < .05$ means that parameter estimates significantly differ from listed groups at $p < .05$.
*$p < .05$, **$p < .01$, ***$p < .001$, $^{\dagger}p < .10$

Table 11.
Multilevel Regression for Spring Math

	Est.	SE
Within-level		
Fall Math	.64***	.02
Sex: Male	-1.10**	.38
Family Low Income	-1.19*	.53
SNAP Math	.09†	.05
Residual Variance	71.97***	.00
Between-Level		
Fall Math	.62***	.03
Sex: Male	-.78	1.29
Family Low Income	-2.94***	.67
Teacher Education	-.06	.15
Child Ratio	.08	.07
SNAP Math	.11**	.04
Instructional Climate	.74**	.27
Residual Variance	7.55***	1.73
Intercept	99.23***	.21

Note. *$p < .05$, **$p < .01$, ***$p < .001$

Table 12.
Multilevel Regression for Spring Expressive Language

	Est.	SE
Within-level		
Fall Expressive Language	.73***	.02
Sex: Male	-.76*	.35
Family Low Income	-1.24*	.49
SNAP Oral Language	.02	.06
SNAP Book Reading	.05	.08
SNAP Prereading	.01	.07
Residual Variance	60.59***	2.17
Between-Level		
Fall Expressive Language	.73***	.02
Sex: Male	-.75	1.11
Family Low Income	-3.10***	.57
Teacher Education	-.26*	.13
Child Ratio	.09	.06
SNAP Oral Language	-.14***	.04
SNAP Book Reading	.01	.05
SNAP Prereading	.02	.06
Instructional Climate	1.40***	.24
Residual Variance	3.09*	1.28
Intercept	93.89***	.18

Note. *$p < .05$, **$p < .01$, ***$p < .001$

APPENDIX B

FIGURES

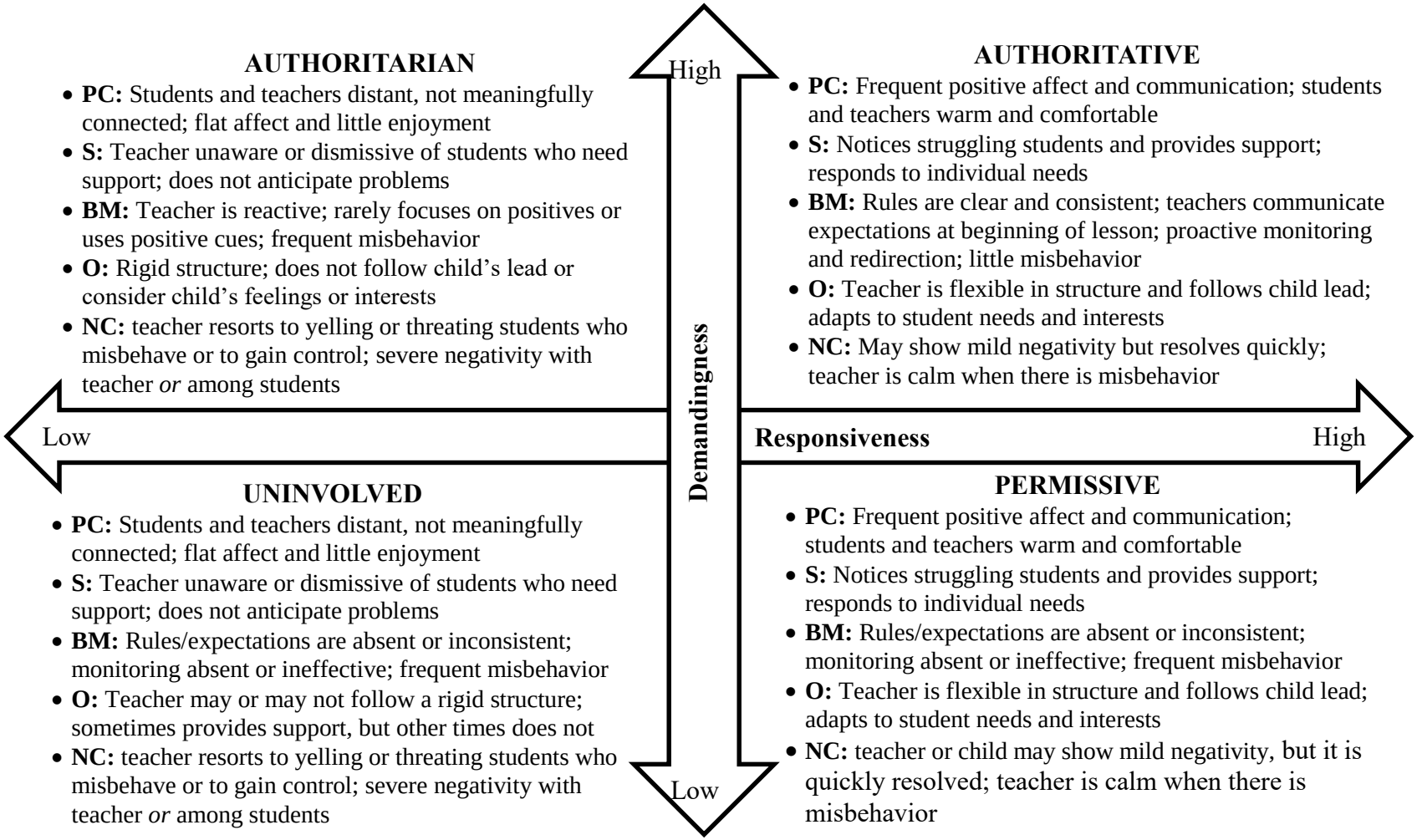

Figure 1. Descriptions of CLASS ratings by teacher-child interaction style
Note. Descriptions from LaParo et al. (2009) and Pianta et al (2008). PC = positive climate; S = sensitivity; BM = behavior management; OC = overcontrol; NC = negative climate.

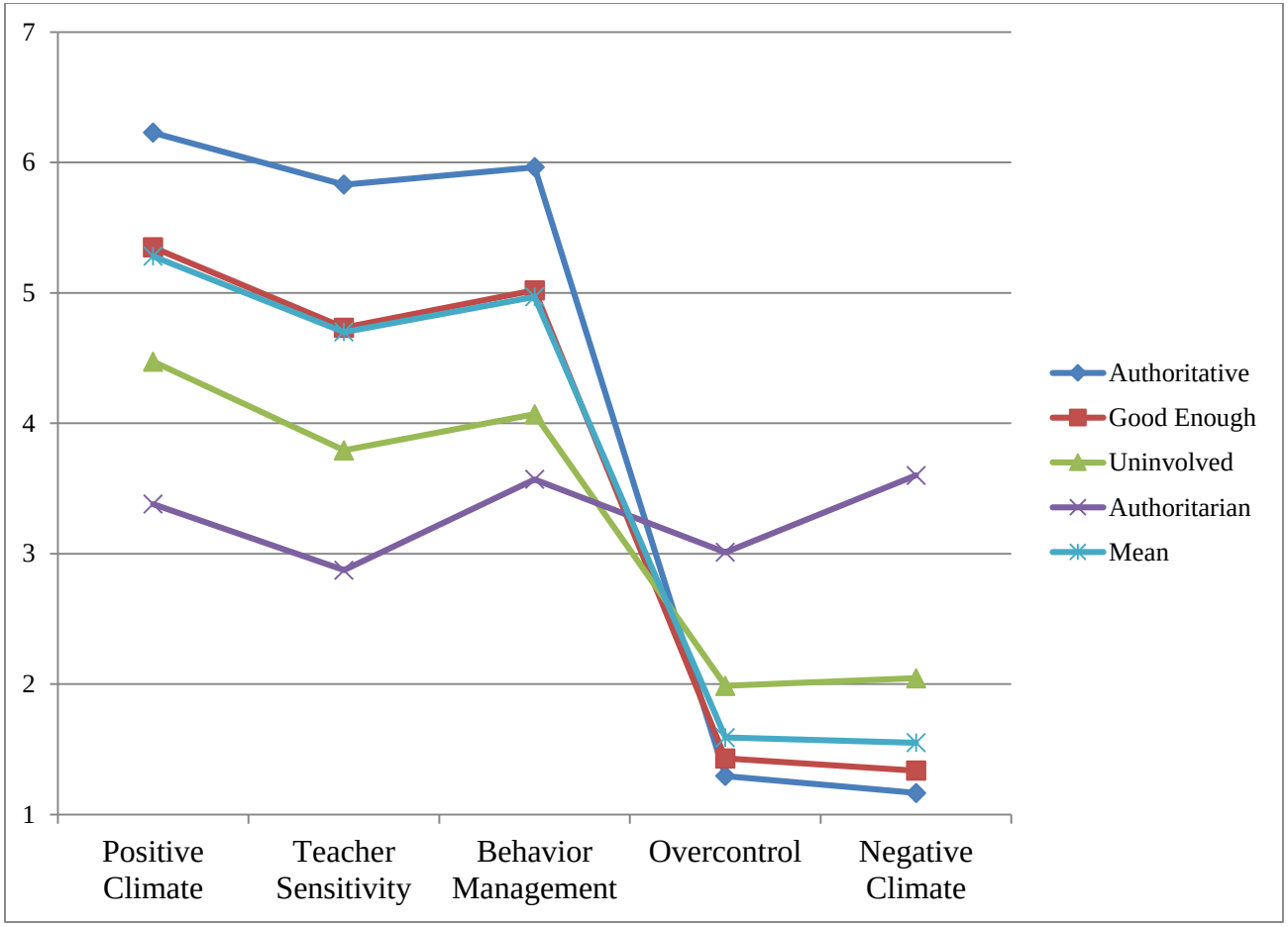

Figure 2. Groups of teacher-child interaction styles from LPA
Note. All profiles differed at $p < .05$

APPENDIX C

IRB APPROVAL

Oklahoma State University Institutional Review Board

Date:	03/19/2019
Application Number:	HS-19-19
Proposal Title:	Teacher-child interaction styles in pre-kindergarten
Principal Investigator:	ASHLEY Kimble
Co-Investigator(s):	
Faculty Adviser:	LAURA HUBBS
Project Coordinator:	
Research Assistant(s):	
Processed as:	Not Human Subjects Research

Status Recommended by Reviewer(s): Closed

Based on the information provided in this application, the OSU-Stillwater IRB has determined that your project does not qualify as human subject research as defined in 45 CFR 46.102 (d) and (f) and is not subject to oversight by the OSU IRB. Should you have any questions or concerns, please do not hesitate to contact the IRB office at 405-744-3377 or irb@okstate.edu.

Sincerely,
Oklahoma State University IRB

VITA

Ashley Renee Blakely Kimble

Candidate for the Degree of

Doctor of Philosophy

Thesis: TEACHER-CHILD INTERACTION STYLES IN PRE-KINDERGARTEN CLASSROOMS: IDENTIFICATION AND RELATION TO TEACHING PRACTICES AND EARLY LEARNING

Major Field: Human Sciences

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Human Sciences at Oklahoma State University, Stillwater, Oklahoma in May, 2019.

Completed the requirements for the Master of Science in Human Development and Family Science at Oklahoma State University, Stillwater, Oklahoma in 2014.

Completed the requirements for the Bachelor of Science in Human Development and Family Science, option in Early Childhood Education at Oklahoma State University, Stillwater, Oklahoma in 2009.

Experience:
Instructor of Record, Oklahoma State University, 2016-2018
Courses taught: Research Methods; Family, School, and Community
Graduate Teaching Associate, Oklahoma State University, 2014
Graduate Research Associate, Oklahoma State University, 2012-2017
Kindergarten Teacher, Putnam City Schools, Oklahoma City, 2009-2012

Professional Memberships:

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Society for Research in Human Development
National Association for the Education of Young Children